

EXHIBIT “G”

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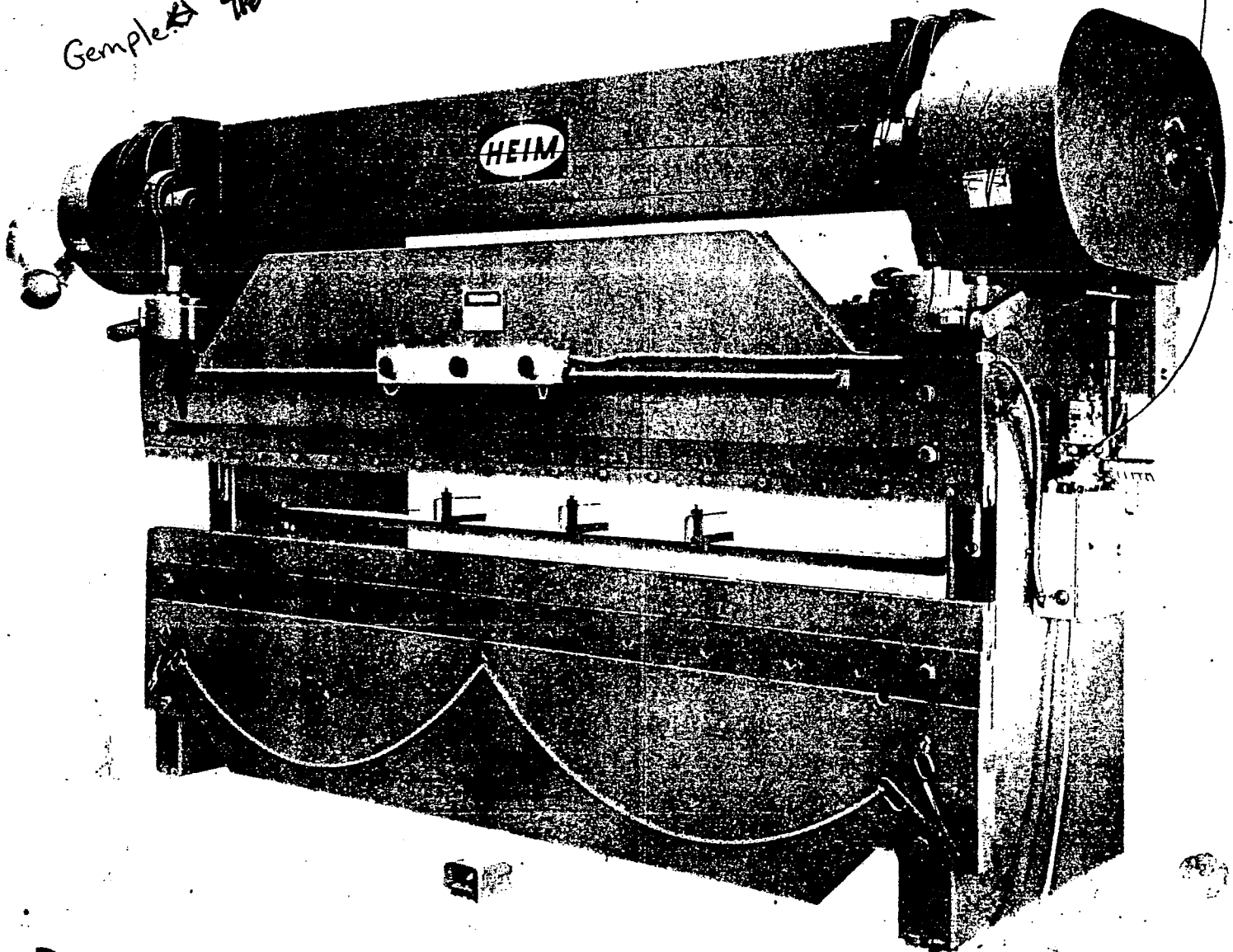
INSTRUCTIONS AND PARTS BOOK

Model # 70-6
Sn# 2176



MECHANICAL PRESS BRAKES

Heim.
1-800-927-9393
Gemple # 412-635-0466



HEIM CORP.

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NOTE

Providing safe and proper working conditions and point-of-operation safety devices consistent with the use and operation of the machine are determinations to be made by, and the sole responsibility of, the user of the machine.

KEEP OUT!!!
MACHINES NEVER REACH OUT TO HARM ANYONE
BUT
WHEN YOU REACH IN, ACCIDENTS CAN HAPPEN

PRESS OPERATOR SAFETY PROCEDURE

Although these instructions are written specifically for press brakes, the same general rules apply to punch presses and other machinery in this category.

NEVER place any part of your body in, or even near, the dangerous die area or any other moving part. STOP - AND THINK! Presses will not just bruise and scratch you, but are capable of severing fingers, hands, and even arms. STOP - AND THINK!

CAUTION

1. DO NOT operate this machine until you have read these instructions. Be sure you understand them, and ask your employer to explain what you do not understand.

CAUTION

2. DO NOT eliminate or bypass any of the safety devices installed on the machine.

CAUTION

3. DO NOT place fingers, hands, arms, elbows, heads, or feet in the dangerous die area or near any other moving part.

CAUTION

4. DO NOT reach into die area to lubricate tooling. ALWAYS use long handle brushes, swabs, rollers, etc. or remote lubrication arrangements.

CAUTION

5. DO NOT "tie down" clutch actuating devices to provide continuous operation.

CAUTION

6. DO NOT tamper with the factory setting of any safety device.

CAUTION

7. DO NOT rotate flywheel under power unless flywheel guards are in place.

CAUTION

8. DO NOT stand or sit on any thing while feeding machine that could cause you to fall, slip, or stumble into die area under ram.

CAUTION

9. DO NOT store die bars, or the like, in gap of machine, lest they fall out and up-end into the ram at the bottom of the stroke.

CAUTION

10. DO NOT operate the machine on leveling screws or skids. Bolt directly to floor or foundation.

CAUTION

11. DO NOT become careless or over confident because of preoccupation, inattention, distraction, talking, or because of the rhythm of the machine.

CAUTION

12. DO NOT remove WARNING PLATE, OPERATORS MANUAL or WORK

PRESS OPERATOR SAFETY PROCEDURE

HANDLING TOOLS from the machine.

CAUTION

13. ALWAYS use safety tools, fixtures, and supporting devices for loading and unloading, especially in narrow forming, piercing, and notching operations. If long wide sheets need to be held during forming operations, then support material from below with open palm of hand, keeping fingers and thumbs below material.

CAUTION

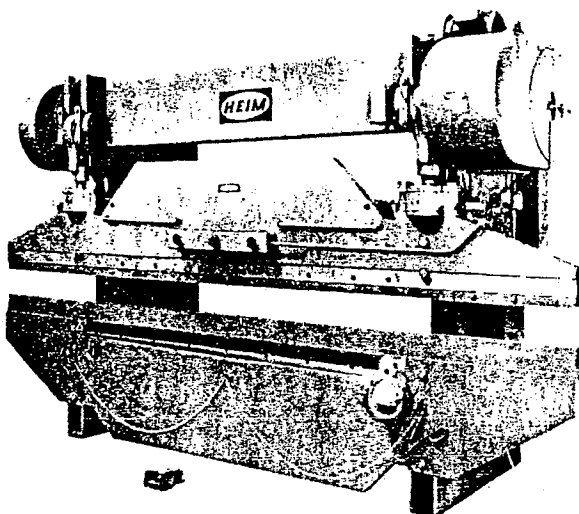
14. ALWAYS disengage clutch, stop drive motor, open disconnect switch, and allow flywheel to come to

rest before making any adjustments, repairs, replacements, or leaving the machine. If necessary to position the ram above bottom of stroke, ALWAYS support the ram by inserting safety blocks between the bed and ram. Be sure the safety blocks are adequate.

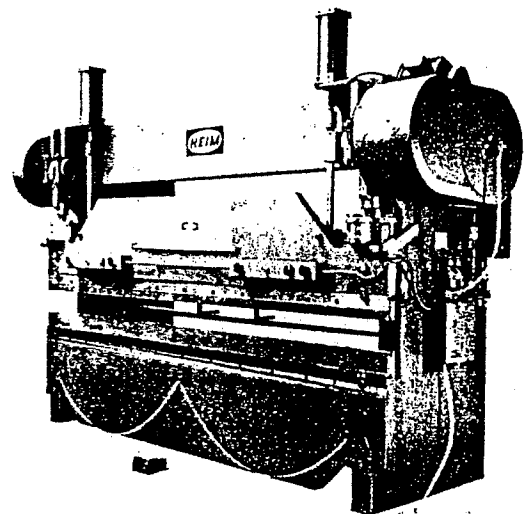
CAUTION

15. ALWAYS protect auxiliary shop equipment so as to preclude any hazard to the operation of the machine, e.g. provide skirts around the bottom of stools, rolling loading tables, etc. so they cannot jam or actuate the clutch mechanism of any machine.

TYPICAL OPTIONALLY EQUIPPED PRESS BRAKES



Model 100-12 with double 24" horns, machined for angles including an operator's palm button station and manual foot operated back gauge.



Model 100-12 machined for removable angles, including two palm button stations for punching, piercing, blanking, etc.



YOUR ASSURANCE OF QUALITY PERFORMANCE

POINT OF OPERATION SAFETY DEVICES

MANUFACTURERS (as listed in "BEST'S SAFETY- MAINTENANCE DIRECTORY")	PRESS FEEDS				SLIDE	SUCTION CUP FEEDING TOOL	MAGNETIC FEEDING TOOL	TONG & PLIER TYPE FEEDING TOOL	MISCELLANEOUS DEVICES	DIE SPACE DEVICES	CONTROLS
	DIAL	ROLL	HOPPER	SHUTTLE							
Alfred M. Best, Inc. Post Office Box 600 Morristown, New Jersey 07960											
Cooper Weymouth Inc. H. E. Dickerman Mfg. Co. Durant Tool Co. Frank W. Egan & Co. Magni-Power Co. Inc.		• • • •		• • •	• •		• •		• •		•
L. M. Lind Engineering F. J. Littell Machine Co. W. I. Martin & Co. Osborn Mfg. Co. Searjeant Metal Products Inc. Jess Corp.		•				• • •	• • • •	• • •	•	•	• •
Magline Inc. Wolverine Tool Co. American Allsafe Co. Inc. John Humm Safety Equipment Corp. Clark Controller Co.						• • •	• •	•	• •	•	• • • • •
Micro-Switch Div. of Honeywell Tapeswitch Corp. of America Schrader Div., Scovill Westinghouse Air Brake Junkin Safety Appliance Co. Inc. Safeguard Mfg. Co.									•	•	• • • • •
Wiesman Mfg. Co. Inc. Luther Mfg. Co. Inc. Falstrom Co. Security Controls, Inc. Wintriss Controls Homestead Valve Mfg. Co.									• • • •		• • • •
Parker-Hannifin Corp. Dilley Mfg. Co. Mine Safety Appliances Co. Mannis Winch & Steel Co. Inc. Acme Wire & Iron Works Kirk & Blum Mfg. Co.									• • • • • •		• • • • •

PRESS OPERATORS DAILY SAFETY CHECKS

The user should determine that the use of the machine on any particular day's operation does not require a change in point of operation safety devices before proceeding with other safety checks. If the use of the machine, or the tools, or the dies, has changed the operational safety requirements, that determination should first be made and appropriate devices should be fixed or attached to the machine before the day's operations are started.

1. KNOW YOUR MACHINE. Carefully inspect it for damage before turning on power to the machine. Clean machine and inspect carefully for loose, worn, damaged, or broken parts, paying particular attention to linkages, oil lines, belts, springs, and chains.
2. INSPECT machine and dies for safe operating condition. Remove tools, parts, etc. from working area. Check tightness of tooling and attaching parts on ram clamp bars, die holders, clamps, and all bolts and lock nuts.
3. REPORT any questionable operation of unusual action of the machine to a proper authority. Report any increasingly excessive bearing and gear noise.
4. CHECK clutch and brake for proper operation.
5. CHECK operating devices and guards for proper placement, adjustment, and condition.
6. DO NOT OVERLOAD MACHINE. Maintain close inspection of machine operation for overloading. Accidental or intentional operation above the maximum rated capacity results in excessive and destructive wear of the machine and dies.

MACHINE CAPACITY IS BASED
UPON AN EVENLY DISTRIBUTED
LOAD OVER THE FULL LENGTH
OF THE MACHINE.

USERS MAINTENANCE SAFETY CHECKS

WARNING: Always leave ram at bottom of stroke, turn off drive motor, open disconnect switch and allow flywheel to come to rest before attempting any inspection, repair, or replacement. Also, turn off air supply. Obviously, electrical power and air supply need be furnished for certain inspections--but use caution!

ALL MACHINES

1. **BEARINGS.** Check bronze-bushed bearings for excessive wear and looseness. Replace worn bearings. Check anti-friction bearings for increasingly excessive noise. Feel bearing housing for heat too hot for hand to rest on as symptomatic of possible trouble.
2. **BRAKE.** Check for disc wear, spring tension, proper release and application. Check that unit is securely mounted. Check quick exhaust valve for proper operation.
3. **CAP SCREWS.** Check all cap screws and attaching parts for proper tightness, paying particular attention to the bed, flange bearings, and pitmans.
4. **CLUTCH.** Check for proper operation in engaging and disengaging. Operation must be smooth and positive. Blow out with air hose once a week.
5. **DRIVE GEARS AND TAPER KEYS.** Check gears, pinions and keys for evidence of wear and for tightness.
6. **DRIVE MOTOR.** Check for overheating.
7. **FLYWHEEL.** Check direction of rotation and if free-running.
8. **RAM GUIDES.** Check guide bearings and lubrication for proper clearance.
9. **GUARDS & COVERS.** Inspect covers on moving parts for proper installation. Repair or replace if damaged. Report any conditions that would require operational guards. Report any bypassing of guards and safety devices by operators.
10. **LEVEL.** Check level of machine from left to right and front to back. Check if secured to foundation.
11. **LINKAGE.** Inspect for loose, worn, damaged, or broken parts, especially springs, pins, and retaining rings.
12. **LUBRICATION.** Check and lubricate according to chart.
13. **RAM ADJUSTMENT.** Check operation of any limit switches for maximum travel of adjustment valve and piping for any changes that might impair operation. Check adjustment screw action and threads for damage of foreign matter that might impair their operation.
14. **RAM CONNECTIONS.** Check for excessive play-clearance.

USERS MAINTENANCE SAFETY CHECKS

15. RAM COUNTERBALANCE. Check set screws on clevis-piston connection. Ensure that adequate and constant air pressure is being supplied. Bleed air prior to disassembly.
16. RAM CYCLING. Check for binding action.

17. SHARP DIE EDGES. Examine dies (when installed) for sharp edges and pinch points which may have developed as a result of use, to prevent injury to operators and machine.

AIR EQUIPMENT

1. CONNECTIONS. Check for leakage and condition of fittings.
2. GAUGES. Check for proper pressure settings.
3. LUBRICATOR. Check and replenish oil supply. Clean filters.

4. SUPPLY. Ensure adequate and constant.
5. HOSES. Check for cuts, kinks, etc.
6. VALVES & SOLENOIDS. Check for proper operation. Check for tampering with factory setting of any air safety valves.

ELECTRICAL EQUIPMENT

CAUTION: Replace components whenever doubtful about operating condition. Ensure components are always "clean" and free of oil, water, etc., to lengthen service life. Check components at least once every two months.

1. COILS. Check solenoid, starter and relay operating coils, for burn spots which indicate shorted turns in windings.
2. CONTROLS. Before each operating shift, check condition and operation response of panel selectors and push-buttons, palm button and foot pedal operating control stations, as well as lever and rotary cam valves.
3. COVERS. Never leave covers off components.

4. FITTINGS. Tighten loose screws, nuts, washers, pins, etc. and replace those that are missing. Check cord and conduit for damage, especially at fittings. Replace loose and burned wires.
5. MOTORS. Blow out periodically with "clean" compressed air. Remove relief plug when lubing (per LUBE instructions) to prevent excess lube from damaging windings. Check for excessive heat. Ensure control circuit fuse never exceeds capacity of transformer.

USERS MAINTENANCE SAFETY CHECKS

Safety awareness...safety checks...routine safety maintenance...these can be demanding, bothersome, nuisance factors in the day-to-day operation of a factory. But their reverse...the destruction of life or limb and the waste of valuable time, materials, machines, and equipment...are far more devastating than any boredom that might result from the very routine of safety precautions and safety measures.

This is why we urge you to take a positive...not a negative...view of safety, to instill in every one of your associates the importance of running a safe machine in a safe shop.

Yet, because all the rules in the world aren't sufficient safeguards against accidents, modern safety engineering skills have confronted the problem...and developed means of controlling them for greater safety of users and operators.

Countless electrical-electronic and pneumatic controls and operating devices have been considerably improved and sophisticated in recent years as the manufacturers continue their research for greater safety.

In the interests of both present and prospective press users, we call your attention to some of these modern safety packages. Incorporate them into your new machines.... or use them to replace original equipment on your older models. Insist on them.....

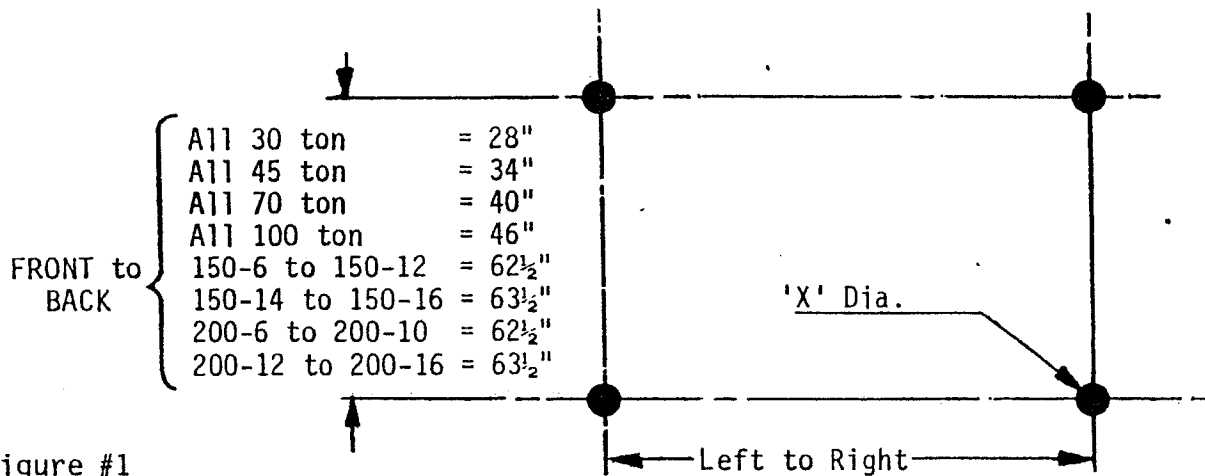


Figure #1

LEFT TO RIGHT								
PRESS	4'	6'	8'	10'	12'	14'	16'	'X' Dia.
30 ton	43"	67"	91"	115"				1"
45 ton	43"	67"	91"	115"	139"			1"
70 ton	47"	59"	83"	107"	131"	155"		1½"
100 ton		59"	83"	107"	131"	155"		1½"
150 ton		62"	86"	110"	134"	158"	182"	1½"
200 ton		62"	86"	110"	134"	158"	182"	1½"

Note: The above dimensions are approximate. Check the actual press for exact dimensions required.

INSTALLATION

SHIPPING AND RECEIVING

All HEIM press brakes are completely assembled, inspected, test run and adjusted at the factory. To facilitate shipping, and to prevent damage, various parts may have been removed and strapped to the press, or boxed seperately.

Upon receiving your press brake, inspect it thoroughly for bent, broken, damaged or missing parts. If damaged, notify the carrier for a 'claims inspection' and also advise HEIM CORP. With F.O.B shipments, a claim must be presented to the carrier by you, the customer.

Title to the press changes to the customer when the shipment is accepted by the carrier.

UNLOADING

To unload the machine, use a crane of sufficient capacity to lift the press. Lifting by fork truck is NOT recommended. Check the capacity of the lifting equipment such as slings, chains, hooks, cables, etc. before handling the press. Use only an experienced operator on the lifting equipment.

The presses may be lifted by putting the hooks in between the side frame plates on each side and around the backshaft. Use a spreader bar on the slings between the side frames. This is important to prevent pulling the side frames in when lifting. Care must be taken not to bind the slings on the main motor. Some machines may have lifting notches or lugs near the bottom of the press on the inside side frame plates. When lifting with these notches or lugs, be sure that the legs of the slings are between the backshaft and the crown. This is very important as the machine is top heavy and this method prevents the press from tipping over.

CAUTION

Machine is very top heavy and also front heavy. Attach lifting equipment securely and lift very carefully. Use protective measures to prevent damage to finished surfaces.

FOUNDATION

1. Before moving the machine in place, check its proposed location. The foundation or floor must be rigid enough to support the machine without settling. Six inch thick reinforced concrete is adequate for presses up to 100 ton. Eight inch thick reinforced concrete should be used for presses 150 ton and up.
2. Refer to figure #1 for mounting hole spacing and hole size. Check the location of your mounting bolts to see that they match up with the dimensions shown on the chart.

INSTALLATION

FOUNDATION (Cont.)

1. Prepare for shimming by placing steel plates of equal thickness over each foundation bolt. These plates will provide a bearing surface for the leveling shims.

RECTIFYING

1. Raise the machine and remove the skidding and blocking.
2. Lower the machine down over the foundation bolts. Bolt the machine loosely at this time.
3. Remove all the parts that are strapped to the machine. Remove the plastic cover from the drive motor.

CAUTION

Machine is top heavy and every step must be taken to prevent the machine from tipping whenever it is raised or lowered.

CLEANING

1. Remove the rust preventative coatings from all bearings and machined surfaces.
2. Clean the entire machine thoroughly to remove any dust, dirt, cinders, sand, salt, or any other type of foreign material that may have accumulated during shipment or storage.
3. USE NON-TOXIC AND NON-FLAMMABLE CLEANING FLUIDS WITH THE PROPER VENTILATION. AVOID CONTACT WITH THE SKIN AND DO NOT INHALE ANY VAPORS.

LEVELING

1. Remove the die holder from the press bed, and using a precision level (with ten second accuracy) on the bed, raise the machine to place flat steel shims under each press foot as required. Allow the bubble to come to absolute rest before checking the reading.
2. Check the press with the level cross-wise on the bed as shown in Figure #2. Do this on the left and the right end of the bed. The bed must be free of nicks, burrs and dirt.
3. Place the level in the center of, and parallel to, the bed as shown in Figure #3. Shim the right or left side as required. Place equal thickness shims under front and rear foot of each side.
4. Keep repeating the above procedure until level is obtained. Bolt down each foot securely. Recheck level.

INSTALLATION

LEVELING (Cont.)

5. Check the level of the machine after a few weeks of running, and periodically after that. Buildings settle and floors warp so do not expect a machine to stay level permanently.

NOTE;

Do not use shock absorbing pads of any kind since proper leveling cannot be obtained and maintained when they are placed between feet and foundation.

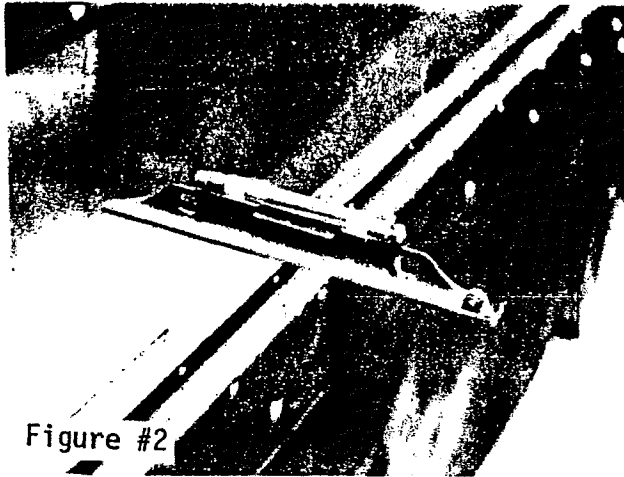


Figure #2

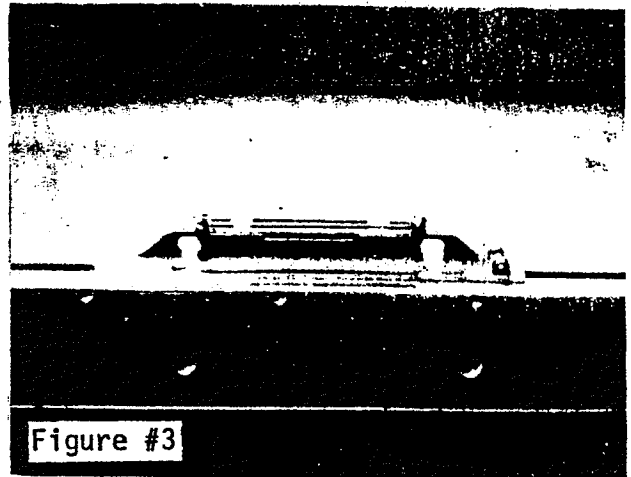


Figure #3

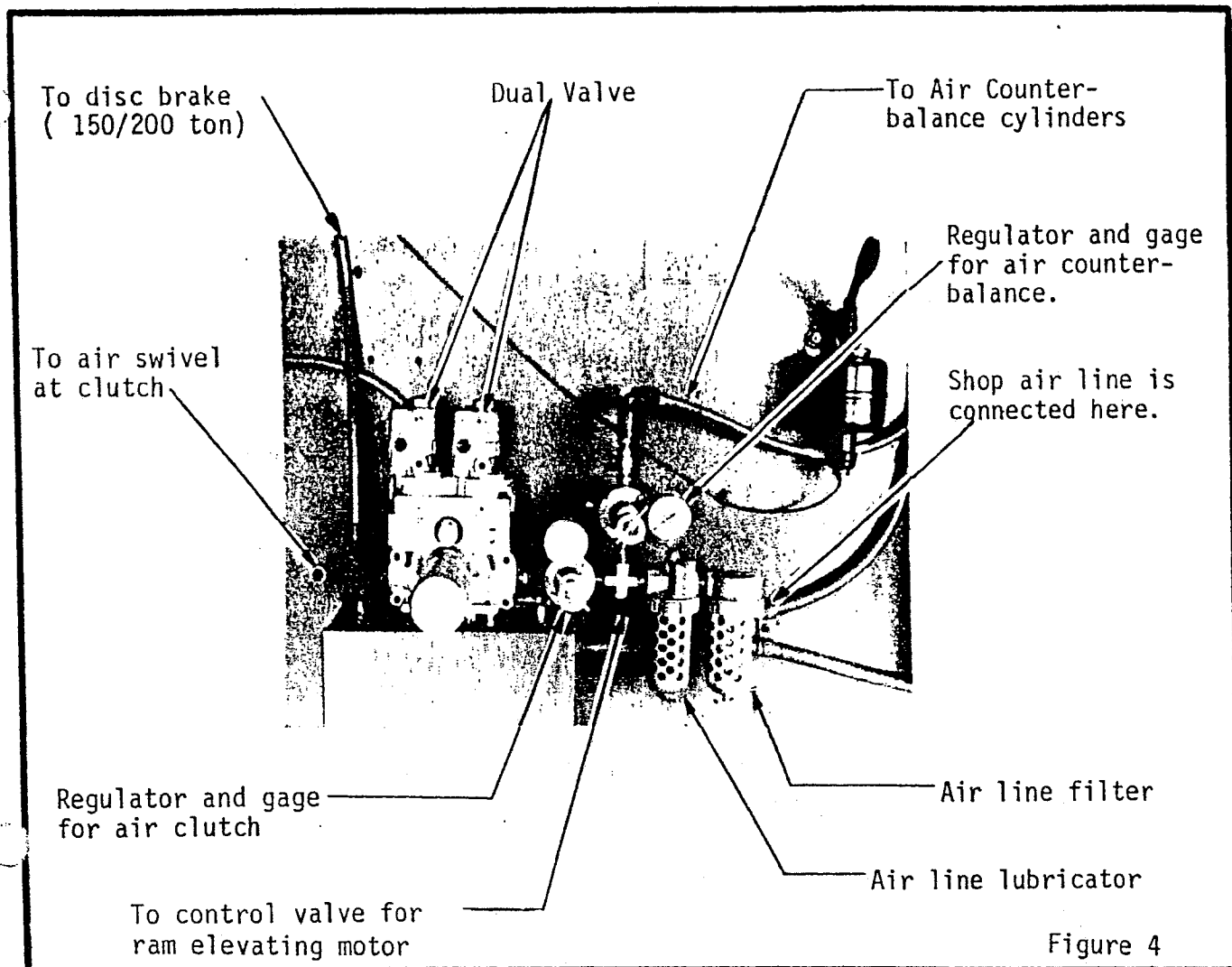
ELECTRICAL CONNECTIONS

1. High voltage is used to operate this press which can result in serious injury or death if care is not taken while handling this power. USE ONLY AN EXPERIENCED, QUALIFIED PERSON TO INSTALL OR SERVICE THIS EQUIPMENT. All electrical equipment must be installed according to the local or National Electric Code.
2. The press is shipped with a combination fused disconnect box and starter as standard equipment, as is the drive motor. A step-down transformer is also standard, providing 110 volts AC for control circuits, etc.
3. Before making any connections, be sure the heaters, starter coils, etc. are the correct voltage for your power supply.
4. If the drive motor is shipped dismounted, install the drive motor and the V-belts onto the machine. Connect the leads coming from the starter box to the motor. Use connection diagram shown on the motor nameplate.
5. Check the motor rotation. ALL drive motors should rotate counter-clockwise as viewed from its shaft end. DO NOT ACTIVATE PRESS! If rotation is wrong, change any two leads AT THE MOTOR ONLY! This is important because of other internal wiring.

INSTALLATION

AIR LINE CONNECTIONS

1. All HEIM press brakes come with an air line filter, regulator and lubricator as standard equipment.
2. Connect the shop air line to the press at the air filter, usually located on the right side of the press. Use a minimum of 1/2" pipe for the 30 and 45 ton models and 3/4" pipe for all others.
3. Air supply should be at least 80 lbs. and no less than 60 P.S.I.
4. All air lines should be new black pipe, clean and free of oil and rust.
5. Pipe runs of more than 50 feet of the same diameter pipe may result in a pressure drop. Avoid long runs or use larger diameter pipe.
6. Re-install the air line to the clutch (from the dual valve) if the press was shipped with it removed.
7. Fill the air line lubricator if required.



LUBRICATION

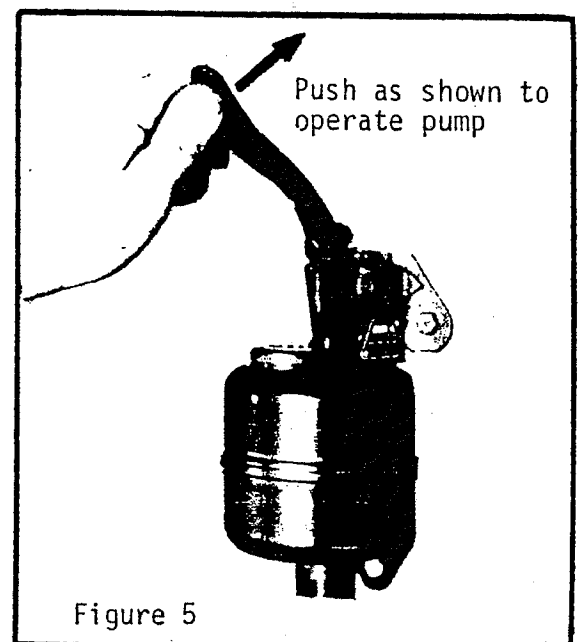
LUBRICATION

1. All HEIM presses are shipped with an all grease fitting system, or a combination of grease fittings and centralized lubrication. The pump for the centralized system may be either the hand operated type or electrically operated.
2. The presses are shipped with very little oil in the pump reservoirs. Fill the reservoir with Texaco 'Waylube G' or equivalent. Check all the lube lines for possible damage such as cuts, kinks, lines pulled out of the fittings, etc. Check lines for clogging or leaking by pushing up on the handle of the manual pump as shown in Figure #5, or by pulling up on the pump rod of the electric model as shown in Figure #6.
3. The flywheel and the flywheel pinion shaft run on sealed ball bearings and do not require attention.
4. The backshaft runs on four (4) ball bearing pillow blocks with grease fittings provided. They only have to be serviced every twelve (12) weeks if the press is used eight (8) hours a day. The frequency of servicing must be increased as the hourly usage per day increases. The left gear guard, the intermediate gear guard and the flywheel guards have to be removed to gain access to these fittings.
5. The bull gears and the backshaft pinion gears are lubricated with Texaco 'Crater 2X fluid' or equivalent. These gears must be lubricated at the same time as the backshaft bearings. The lube is applied to the gears with a stiff brush or a swab.
6. The flywheel pinion and the backshaft drive gear lubricated with oil contained in the oil tight intermediate gear guard. The oil level is checked by removing the lower pipe plug. Fill if required with Texaco 'Rando A' or equivalent.

ONE SHOT SYSTEM

On the 'One Shot' centralized lubrication system, the pump lever must be operated several times during each eight hour day. Check the oil level in the pump so that air is not pumped into the system oil lines. Frequently check each lube point in the system to insure that they are receiving oil.

Vactra #2



LUBRICATION

AUTOMATIC' SYSTEM

The 'Automatic' centralized lubrication system is the same as the 'One Shot' system except that the pump is electrically operated to supply oil to the press at timed intervals. The same precautions should be observed. See figure #8 for instructions.

Some presses have as optional equipment, an automatic pump that also has a low oil level switch. When the oil level in the reservoir goes down below a certain point, the pump will shut off the power to the press. The reservoir must be re-filled again to make the press operative again.

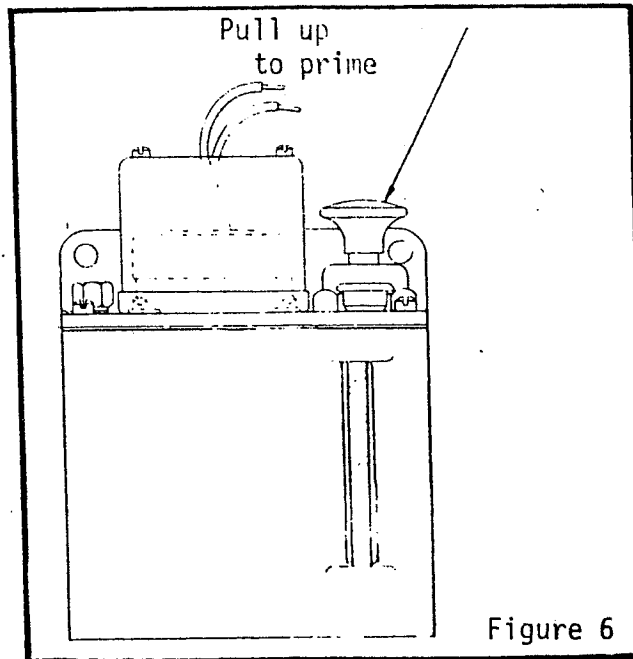


Figure 6

USE TEXACO WAYLUBE 'G' OR EQUIVALENT
IN THE CENTRALIZED LUBRICATION SYSTEM.

Vactra #2

Figure 7

LUBRICATION EQUIVALENT CHART				
	TEXACO	MOBIL	GULF	ST'D OIL
Centralized Lube	Waylube 'G'	Vactra oil #4	Gulfway 75	-----
Grease fittings	Regal AFB 2	Mobilux EP-2	Gulfcrown grease #2	Rykon Grease #2
Open gears	Crater 2X Fluid	Mobiltac 'E'	Gulf Fluid Lubcoat #3	Amaco Compound #159
Enclosed gears	Rando 'A'	Mobil DTE Light	Gulf Harmony 43AW	American Industrial #15
Air Line Lube	"	"	"	"

Service Instructions

For systems with lubricator type TM-1

Your machine is well protected by a built-in Bijur central lubricating system - by CORRECT lubrication of all bearings served, it assures smooth operation of your machine for years, if properly maintained.

The Bijur system consists of three basic elements; (1) A LUBRICATOR which periodically forces a measured volume of oil into (2) a single line of DISTRIBUTION TUBING branched to supply oil to the bearing surfaces through (3) METER-UNITS which proportion the correct oil film to each bearing.

OIL: Use only a clean mineral oil of type and viscosity recommended by machine manufacturer.

OPERATION: The Lubricator is a piston pump of the spring discharge type and driven by a timing motor. The motor drives the pump through a gear train and cam at a predetermined rate. Oil volume is determined by the stroke setting and discharge frequency by the timing motor.

Descent of the piston will be faster as the temperature rises and slower as the temperature decreases. This variation in discharge time compensates for changes in oil viscosity thereby assuring a constant volume of oil pumped to the bearings.

STARTING A NEW MACHINE: Fill reservoir. Pull and release "Instant Feed Button" several times until oil shows freely at all bearings.

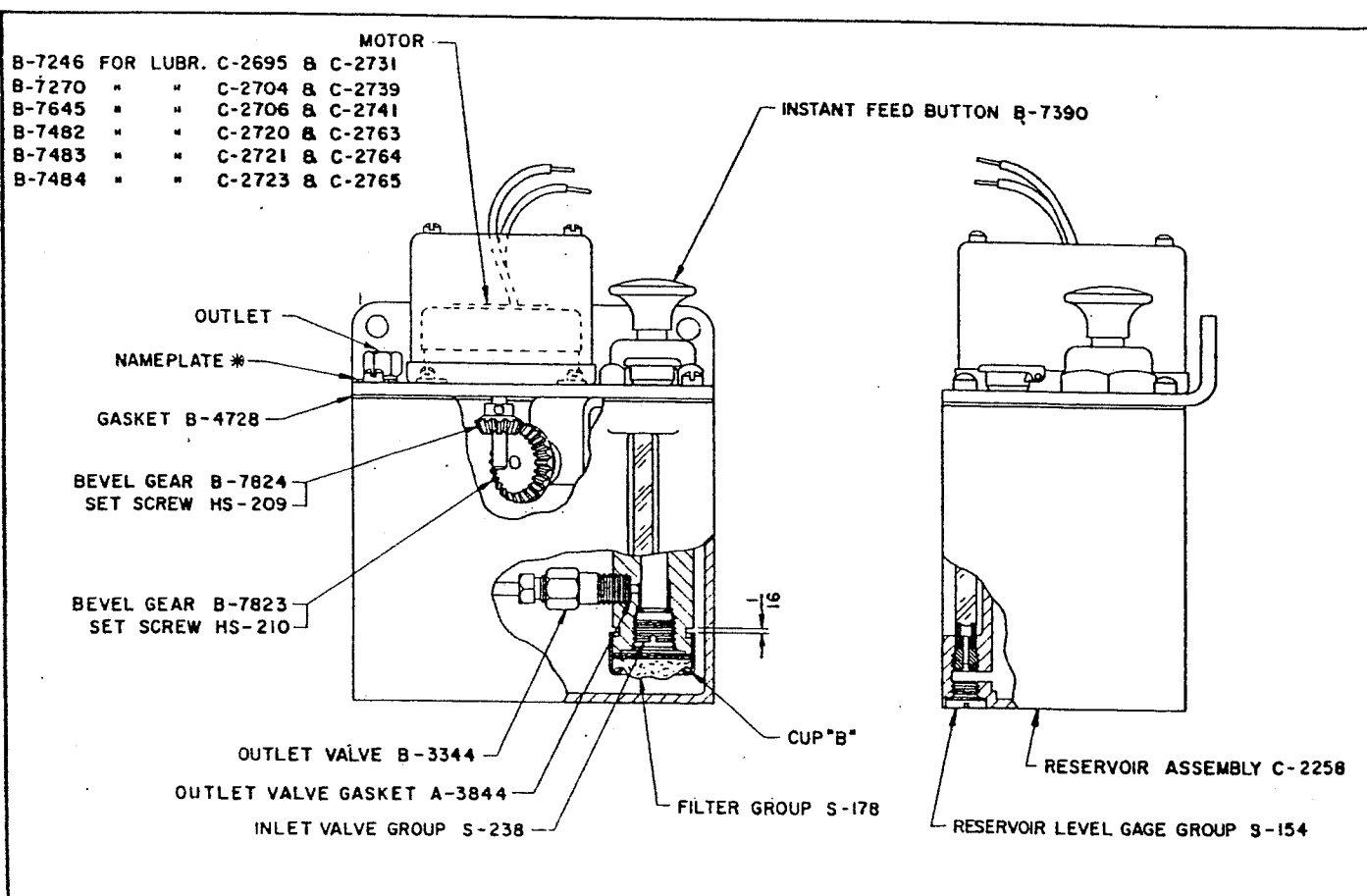
MAINTENANCE: Check oil level daily and refill reservoir when required. Check the system periodically for loose or broken tubing, worn hoses, loose fittings and connections. Replace Filter Group Annually.

SERVICE: Too little oil at all bearings - check for low oil level, broken or cracked tubes, loose connections, flattened lubricator outlet tube, or clogged filter. If one bearing receives too much oil, remove Meter-Unit and replace with one of the same type but next lower Flow Rate Number. For too little oil at one bearing, replace the Meter-Unit with one of the same type but next higher Flow Rate Number. Each increase in Flow Rate Number doubles oil feed. Don't attempt to adjust, disassemble, blow through or drill out Meter-Units.

FILTER REPLACEMENT: A filter at pump inlet protects the lubricating system. The filter disc should be inspected every six months. If not clean, replace. To remove filter pry cup "B" loose in several places with a screw driver. Remove screens and filter disc. Insert new filter disc in cup, then screens, so that coarse screen is next to pump body when installed. Reinstall assembly making sure that it is tight and that the top of the cup is about 1/16" from the shoulder on pump body as shown.

MOTOR REPLACEMENT: Remove Lubricator Unit from reservoir. Loosen set screw on gear and remove the two screws holding motor. Reassemble in reverse procedure, being sure gears are properly meshed.

SERVICE PARTS: Order by Part Number and Name shown below. You must also specify COMPLETE Lubricator Part Number and Serial Letters shown on the Name Plate*. Example: "S-178 Filter Group for Lubricator C-2695, serial AH". For major repairs requiring parts not identified in illustration return lubricator for factory rebuilding and adjustment. If a new lubricator is required for replacement, order by Part Number and Serial Letters shown on the Name Plate. Prompt shipment can be made on parts and lubricators.



IMPORTANT: REPLACE FILTER GROUP ONCE A YEAR

Figure 8

BIJUR LUBRICATING CORPORATION, ROCHELLE PARK, N.J.

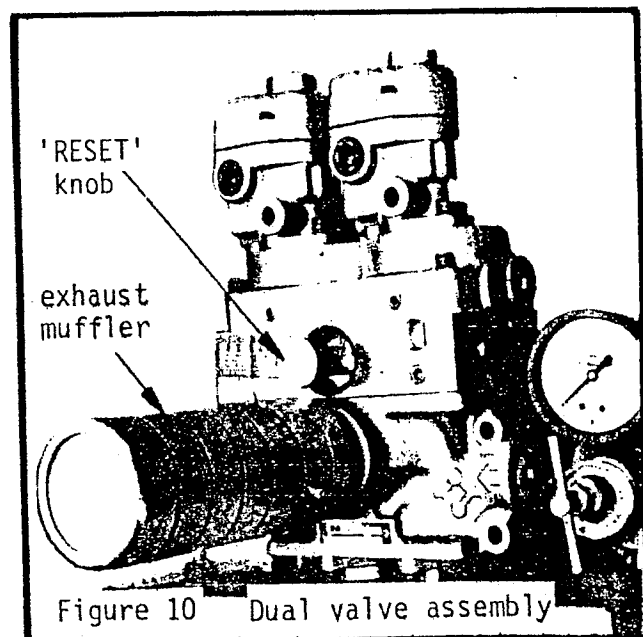
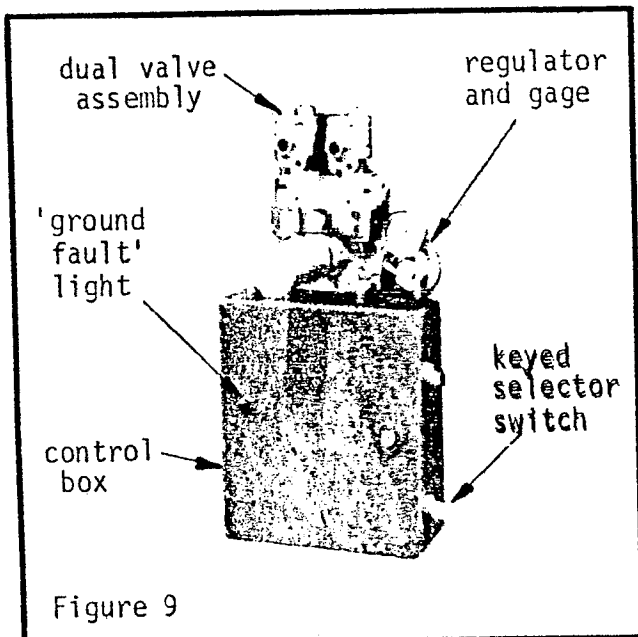
T-1

OPERATION

TRU-KON-TROL system

The TRU-KON-TROL system is a package that incorporates the safety of the dual valve pneumatic system plus the control of the press bending cycles. It consists mainly of a key locked control cabinet, a dual valve mounted on it, and a rotary cam box operated by the crankshaft. The movement of the ram can be controlled as follows;

1. 'RUN'. This gives a continuous movement to the ram as long as the foot pedal, or palm buttons, are held down. When the controls are released the ram will stop at whatever position it is in at that time.
2. 'STOP ON TOP'. When the controls are operated, the ram will come down and go back up and stop at the top of the stroke. The ram cannot be activated again until the controls are released and reactivated. If the controls are released during the ram operating cycle, the ram will stop. Hold the controls 'ON' until the ram comes up to the top of the stroke where it will stop automatically.
3. 'STOP BEFORE WORK' actually controls two movements of the ram. In this function the ram comes down and stops someplace before the bottom of the stroke. This point depends upon the job being done, and its purpose is to stop the ram immediately before it contacts the work material. This prevents 'whip-up' of the material which is dangerous to the operator, and usually puts a permanent arch in the material, causing scrap. After the ram has stopped before striking the material, it is 'jogged' on through the bending of the work by the operator continuously activating and releasing the controls. Each activation will allow the clutch to be engaged for a fraction of a second. This length of engagement can be controlled by a knob inside the control box, and is set according to the material being bent. After this short engagement time has elapsed, the functions all stop even though the controls may still be activated. To repeat the cycle, release the controls and then reactivate them again. Do this over and over again until the ram comes to the bottom of its stroke (bending is now complete) at which time the ram will automatically return to the top of the stroke and stop. Controls must be held down during this upward movement of the ram. NOTE; Refer to ROTARY CAM BOX on page 19 for adjustments.



OPERATION

TRU-KON-TROL system (cont.)

All of these functions are selected by a key switch from the outside of the control box. The supervisor, or set-up man will select the correct function by simply turning the key to that position and removing the key. The clutch engagement time is controlled from inside the cabinet.

On the cover of the control box is a red light. This is a 'Ground Fault' indicator light and will remain lit if there is power to the control box, and if there are no 'grounds' in the control circuit. The light will go out if a ground develops. The control system is fused (located inside the control box). If it burns out, the red light will go off, as will the entire control system. The cause must be corrected and the fuse replaced before the controls will function again.

DUAL VALVE

The Ross dual valve that is mounted on top of the control box are two distinct valves in one casting. They each have their own electrical system in the control box, in the rotary cam box, and in the valve assembly itself. The only connection between them is a pneumatic shuttle valve and a common exhaust port. Any pressure unbalance in the air system within the valve will cause the shuttle valve to shift position, thus making a "RESET" knob to kick out. This unbalance can be caused by one valve sticking, a sluggish valve, a defect in the electrical system, or the cams in the rotary cam box not being timed correctly. This is a safety feature that shuts off the air to the clutch in event of a malfunction, whereas a single valve could stick in the open position and keep the press running even though the foot pedal has been released.

To reset the valve, pull out on the "RESET" knob. However, if the cause of the malfunction is not fixed, the press will only knock out the "RESET" knob again. Find the cause and correct it.

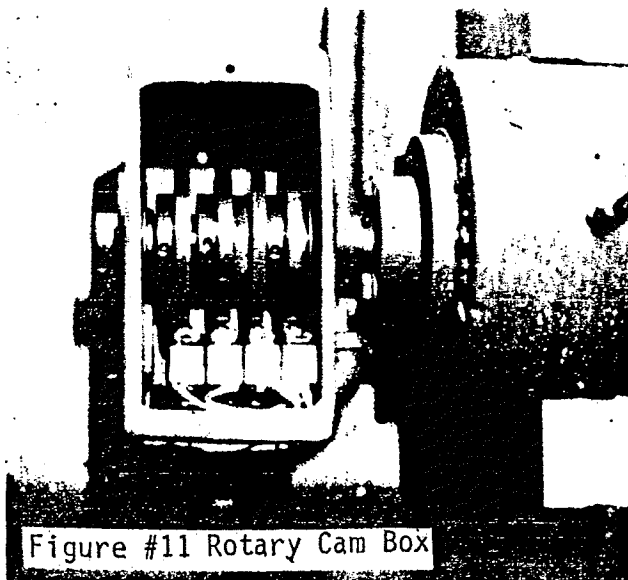


Figure #11 Rotary Cam Box



Figure 12 Foot pedal

OPERATION

ROTARY CAM BOX

Mounted on the end of the crankshaft, usually on the right side, is a rotary cam box. It has a shaft going through it that is driven by the crankshaft. On this shaft are four (4) cams. They can be 'advanced' or 'retarded' as required. These cams in turn activate switches that are also located within the cam box.

Starting with the cam on left is a 'STOP ON TOP' cam and it controls one of the dual valves. The next cam to the right is the 'BOTTOM GO' cam. It is adjusted at the factory and requires no attention. The next cam (3rd from left, or 2nd from right) is the 'STOP BEFORE BOTTOM' cam and it is painted red. This is the cam that the set-up man must adjust for each new job. It stops the ram just before it comes in contact with the work material. The cam on the extreme right is another 'STOP ON TOP' cam and it controls the second dual valve.

The two outside cams must be timed exactly together to keep the dual valve 'RESET' knob from kicking out. Otherwise they do not require any attention.

FOOT PEDAL CONTROL

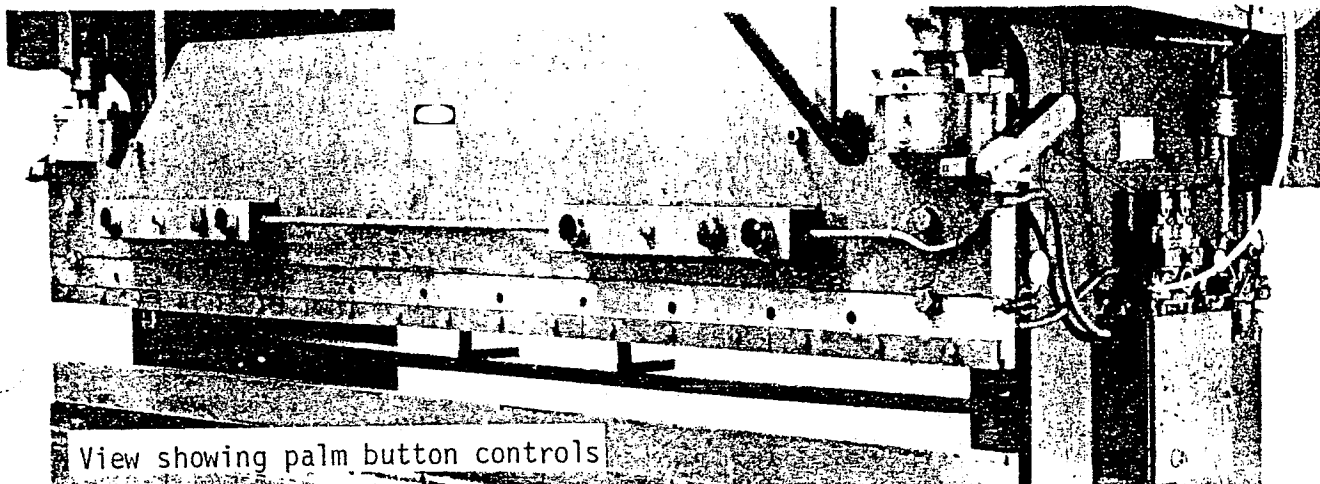
A foot pedal control is furnished as standard equipment on all HEIM press brakes. It is on a long cord and can be moved around to the safest and most convenient place for the operator. It has a cover guard over the top of it to prevent an object from falling on it and activating the press, or an accidental stepping on it.

PALM BUTTON CONTROLS

Optional equipment are palm button controls. These are two buttons placed so that it requires one hand on each to operate the press. There is also an 'EMERGENCY STOP' button included. These controls are usually placed on the front of the ram.

COMBINATION FOOT PEDAL/ PALM BUTTON CONTROL

Also available as optional equipment are both types of controls on one press. However, only one of these systems can be used at one time. To select the system desired, turn the key selector switch to that position and remove the key.



OPERATION

AIR CLUTCH & BRAKE

When the foot pedal or hand buttons are operated, air will enter the clutch through the air swivel. Inside the clutch is a neoprene piston that is fitted to a precision machined cylinder. This piston is flexible and self sealing. The compressed air entering into the clutch forces the piston against the large clutch plate. This in turn causes the small clutch plates and the friction discs to be squeezed together and locked. Since the friction discs are attached to the pinion shaft and the clutch plates are attached to the flywheel, this locking action makes the pinion shaft rotate with the flywheel and thus operate the press.

At the same time the large clutch plate is moved by the piston, it releases its hold on the brakes disc. The larger presses also have a separate disc brake assembly in addition to the integral brake in the clutch. This brake is spring applied and air released. Air that goes to activate the clutch also goes to this disc brake. Thus, when the clutch is activated, the brake is released, and vice versa.

When the air supply to the clutch is cut off, the air is quickly exhausted from the clutch by means of a quick exhaust valve. Spring pressure pushes the large clutch plate against the brake disc, immediately stopping the operation of the press. This movement of the large clutch plate also releases the friction discs and the small clutch plates, thus allowing the flywheel to rotate freely.

The total movement of the piston plate is about .025" and thus, the air consumption is very small and the clutch action is quite fast. The clutch is of ample size, so that wear is held to a minimum. It is self compensating for wear and needs almost no adjustment for the life of the press.

For proper operation of the clutch, it is important that the air pressure is at least seventy(70) pounds, air lines are a minimum of 1/2" pipe, and that there are no leaks or restrictions in the air system.

RAM ADJUSTMENT

30 Ton press brakes do not have power ram adjustment as standard equipment. The ram is raised and lowered by a hand crank furnished with each press.

All other models have power ram adjustment. To raise or lower the ram, simply operate the valve lever in which ever direction is required; i.e. for the ram to go up, move the lever up--for the ram to go down, move the lever down. See Fig. #13. This valve is usually located on the right side of the ram. It operates an air motor which in turn drives the ram elevating mechanism.

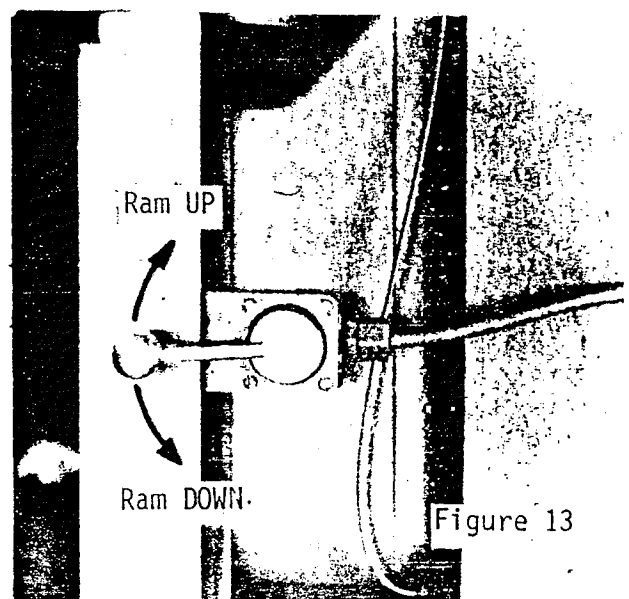
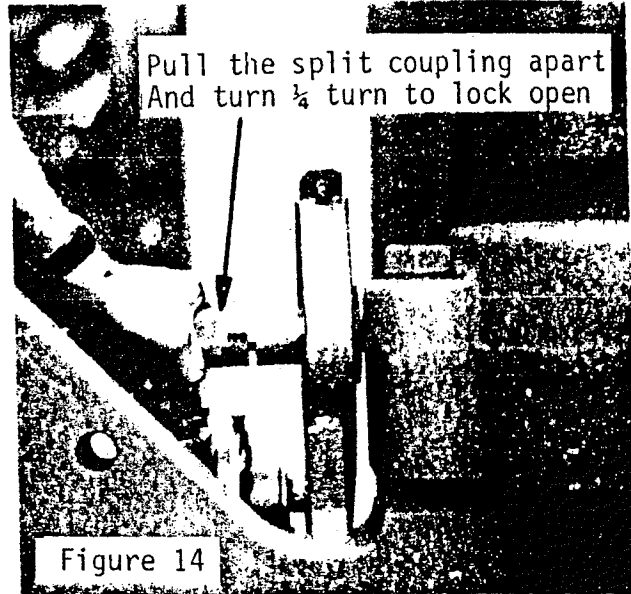


Figure 13

OPERATION

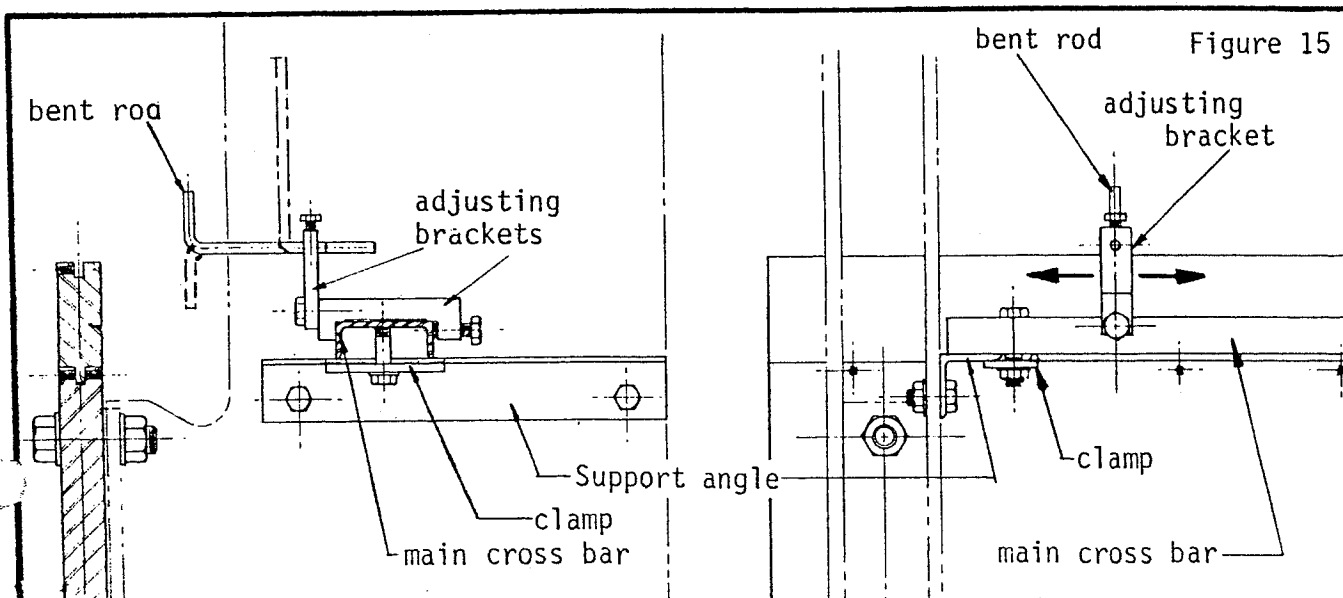
TILTING THE RAM

For some types of work, it is necessary to tilt the ram. To do this, loosen (do not remove) the four bolts holding the ram to the ram guides. Separate the jaw clutch on the ram elevating shaft, as is shown in Figure 14. Raise or lower the one end of the ram as required. When the ram is in the desired position, engage clutch on the shaft and lock the ram bolts up tight. To return the ram to level position again, repeat the above procedure, but bring the one end of the ram up or down until the ram indicators at each end of the press show the same reading. Engage the jaw clutch and lock the ram bolts up tight.



MANUAL BACKGAGE

The manual backgage consists of a main cross bar resting on support angles on each side of the press side frames. The major adjustment is made by loosening the clamps at each end of the cross bar and moving it to, or from the dies as required. Measure each end from the cross bar to the bed. This dimension should be the same within $\frac{1}{2}$ " of each other. The fine adjustment is made with the bent rods that are attached to the cross bar with a bracket. These bars are made with unequal length legs so they can be used in the bracket with the short leg in a vertical position or the long leg vertical and the legs can point up or they can point down. Whichever position is used depends upon the set-up. The mounting brackets are movable left or right on the cross bar so they may be adjusted for different widths of material. Adjust as required and be sure all nuts and bolts are tightened securely before starting work.



OPERATION

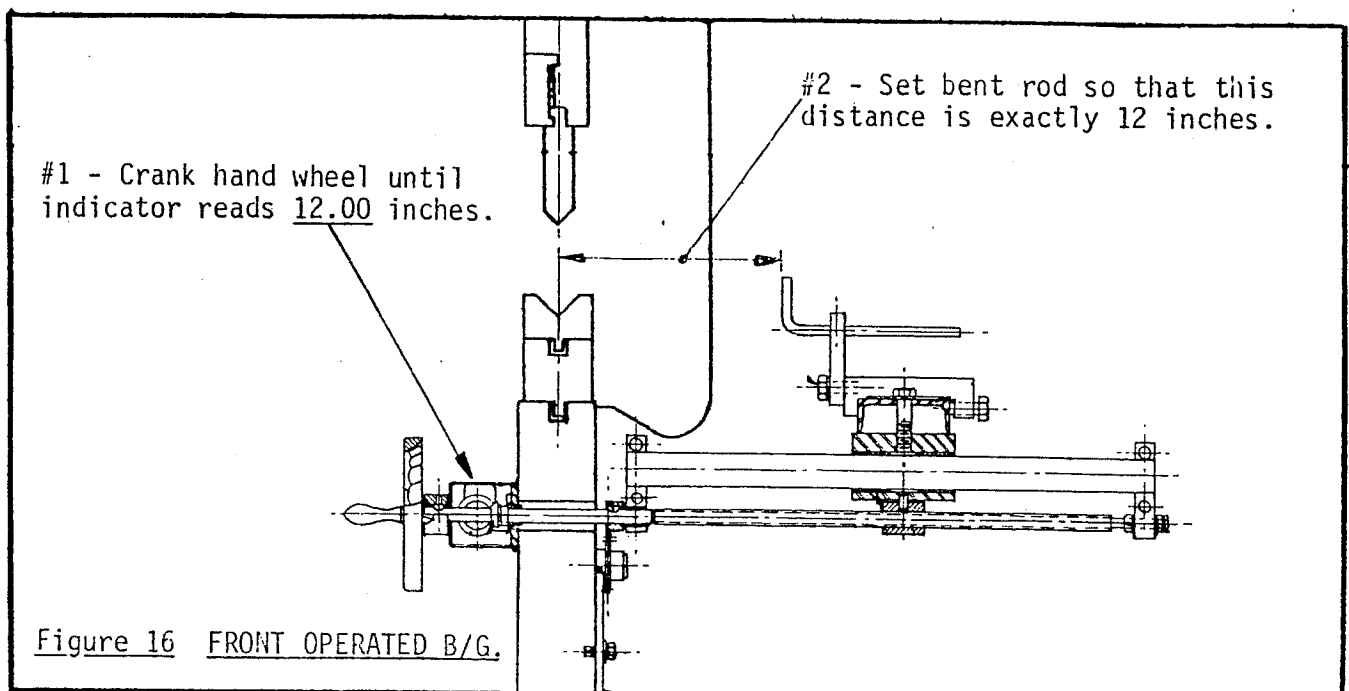
FRONT OPERATED BACKGAGE

As the name implies, the operator can adjust the main cross bar from the front of the press as required. Its greatest advantage is for many jobs of short duration, causing many set-ups to occur during the day. This type of backgag greatly reduces the set-up time because the setting is quickly made from the front of the press. A position indicator is mounted on the front of the bed next to adjusting hand wheel. It is calibrated to 1/16 of an inch.

To initially set-up, or calibrate the backgag, crank the handwheel on the front of the press until the position indicator reads '12.000'. Now adjust the bent rods in the back until the bend line is 12" from the edge of the material (or bent rod). You can now use the indicator for setting the bend distances as long as you use the same set of dies. When the dies are changed, the indicator will have to be re-calibrated as described above.

CAUTION

DO NOT REACH THROUGH THE DIE OPENING TO DO ANY ADJUSTING OR MEASURING OF THE BACK GAGE. SHUT OFF THE PRESS AND WALK AROUND TO THE BACK OF THE PRESS.



OPERATION

AIR COUNTERBALANCE SYSTEM

The air counterbalance system on HEIM press brakes consists of a separate air pressure regulator and gage which are tapped off of the main air supply line. From there, the air goes through a check valve and then to two pneumatic air cylinders mounted on the top of the press at each end. The piston rods of these cylinders are connected to the ram by steel bars. Also included in the system and connected to it pneumatically is an air storage tank commonly called a 'SURGE TANK'.

The purpose of the system is to counter balance the weight of the ram and the upper die. This not only removes the weight load from the main bearings and greatly increases the life of the press, but it makes it run quieter and smoother.

SETTING AIR PRESSURE

If your press is equipped with air counterbalances, then attached to the side of the press, above the air line piping, is a nameplate titled 'AIR COUNTERBALANCE SYSTEM'. Stamped on this plate is the pounds of air pressure required in the system to counter balance ONLY the weight of the ram assembly. Also stamped on this plate is what each additional pound of air pressure will support in upper die weight. Use this chart to calculate the air pressure required in the system to offset the weight of the ram assembly AND the weight of the upper die combined. Set the air regulator to this pressure.

CHANGING DIES

The air counterbalance cylinders require no stroke adjustment when going from one die set to another, or for a change in the ram height adjustment. However, the air pressure in the system will have to be readjusted because of the change in the die weight. Calculate the new air pressure required as described above and set the regulator accordingly. All high grade commercial dies will have the weight stamped on them to aid in these calculations.

MAINTAINENCE

Each week exhaust the air pressure from the system. Then remove the drain plug from the bottom of the surge tank and drain out any moisture that may have accumulated. Replace the drain plug. Squirt about two teaspoons of light machine oil through the top hole of each cylinder. Restore air pressure to the system.

MACHINE JAMMING

1. Causes
 - A. Dies not set in the press with the ram at the bottom of the stroke.
 - B. Heavier gauge material was used in the press than what the dies were set for.
 - C. Machine operated at incorrect speed for operation or type of material.
2. If the press jams, cut off the power and allow the flywheel to come to rest.

OPERATION

MACHINE JAMMING (cont.)

3. Loosen the four bolts holding the ram to the ram guides. The ram may or may not loosen itself from the jam at this time. If it has not broken loose, then pry the top of the ram away from the press. A small hydraulic jack with base placed against one of the side frame plates and the piston placed just below the gear housing on the ram should be sufficient. hard jam may require a jack at each end.
4. After the ram has broken loose, raise the ram up with the ram elevating motor. Remove the work piece and tighten down the four ram bolts. Readjust ram correctly.

TOOLING AND SET UP

INSTALLING DIES

1. Refer to the operating section and be sure you know how to operate the press BEFORE installing any tooling. Practice operating without any tooling in place.
2. DO NOT ever put hands, arms fingers, or any other part of your body in between the dies!
3. Raise the ram all the way up with the ram adjusting motor. Inch the ram down to the bottom of the stroke with the controls. Stop the drive motor and allow the flywheel to come to rest
4. Slightly loosen the set screws holding the lower die holder. Install the lower die in the die holder. Tighten the set screws in the die block holding the lower die.
5. Remove one end ram clamp from the ram. Provide a support for the upper die so that it can rest on the lower die on one end and on the support on the other end. Loosen the remainder of the ram clamps. Run the ram down with the ram adjusting motor until the upper die can be slid, on the lower die, through the ram clamps and into position.
6. Install the ram clamp that was removed. Lower the ram with the ram adjusting motor until the upper die is firmly seated in the ram. Tighten all ram clamps.
7. Adjust the lower die and the die holder by means of the set screws in the bed. Set screws in the die holder may also have to be used for adjustment.
8. The height of the ram from left to right may have to be adjusted with the use of different dies. Refer to the operating section for tilting of the ram.
9. Before starting the job, Check to see that the operators working area is not cramped and that he has enough room to avoid the work material as it swings up during the bending. Also be sure there are no wrenches, bars, tools, etc. in between the dies. Provide safety tools best suited for the job and USE THEM!

TOOLING AND SET UP

CHANGING DIES

1. Bring the ram to the bottom of the stroke, stop the drive motor, allow the fly-wheel to come to rest, and cut off power at disconnect switch.
2. Remove the dies from the press using the reverse order described above. Install new dies as described above.

SHIMMING DIES

When setting up a new job and making sample pieces, you may find several conditions regarding the bend in the material. One condition is that the part may be bent correctly at one end, but that the other end has not been bent enough. This is called 'underbent' or 'open'. Too much bend is called 'overbent' or 'closed'.

1. If the part is 'overbent' or 'underbent' on one end, the ram will have to be tilted enough to correct the condition. Refer to the operating section for tilting.
2. If the part is 'underbent' at each end but correct at the center, then the lower die will have to be shimmed up at each end.
3. If the part is correct at each end but 'underbent' in the center, then the lower die will have to be shimmed up in the center.
4. If the part has a bow in the bend, check the alignment of the lower die and adjust as required. If you still have a bow in the bend, the upper die may not be straight due to the ram not being straight. This can be corrected by the ram tension bar mounted on the rear of the ram on most presses. Realign the lower die and die holder as required.
5. USE SAFETY BLOCKS WHENEVER POSSIBLE!

NOTES ON SHIMMING

Shim between the lower die and the die holder. Do not shim between the bed and the die holder.

When shimming the center of the die to increase the 'crown', start at the very center of the die with 12" long shims. Then use 4" long shims and space them 6" apart.

When shimming the ends of the die to decrease the 'crown', start at the very ends with 4" long shims and work toward the center placing the shims 6" apart.

When checking 'overbends', be sure the condition is not caused by the ram being adjusted down too far and causing the material to be 'coined' at the bottom of the stroke.

TOOLING AND SET UP

CONDITION OF DIES

Be sure that the die holder, the lower die, and/or the upper dies are not excessively bowed. This will prevent proper alignment of the dies which the adjustments cannot compensate for.

Be sure that both dies are the same height for their full length. Shimmiing will not correct this. It is most commonly caused by dies wearing in one area. It may also be caused by incorrect machining.

Be sure that the radius on the upper die and the lower die are equal for the full length. Again, this is usually caused by wear.

The upper and lower dies must have the correct mating that allow for sufficient 'springback' of the material.

The lower die should have an opening at least 8 times the thickness of the material being bent. Less than that amount requires excessive pressures to make the bend.

Too sharp a radius on the nose of the upper die also increases the tonnage required to bend. In addition, it may fracture the material or tear it at the bend line. The radius must be at least equal to the thickness of the material being bent.

CONDITION OF THE MATERIAL

The sheets of material must be of uniform thickness. Not thin at the edges and thick in the center.

Wavy material will not produce a straight bend. Also coiled stock that has not been straightened will not produce a straight bend. Put the stock through a straightening machine before doing any bending operations.

A REMINDER!

Keep the hands, fingers, arms, hammers, screwdrivers and the like out of the die area! Use safety tools, fixtures supports, etc. for loading and unloading material from the press. Support the material from below with the open palm of your hand. Keep those thumbs off of the top of the material!

PARTS REPLACEMENT

HOW TO ORDER REPAIR PARTS

When ordering parts, specify;

1. Serial number of the press. 2176
2. Model number of the press. 70-6
3. The correct name and part number of item required.
4. Quantity required.

The serial number will be on a plate on the side of the press. The model number will also be included on this plate.

Part numbers are shown in the assembly drawings included in the last section of this book.

Prices are listed on a separate schedule

IMPORTANT NOTE REGARDING REPLACEMENT BEARINGS.

All bronze bearings (or bushings) shipped to you from the factory for replacement are ROUGH BORED ONLY. They must be bored to size after you press them into their housing.

This manual was created to assist you in the safe operation of your press, to present the correct methods of operation and maintenance for those responsible for operating and keeping the machine running in a safe and proper condition, and to expedite the ordering of repair parts for your HEIM press brake

At the time of writing, the data contained herein was completely up to date. However, due to the continual improvement in design, it is possible that some of the information or illustrations of the component parts may vary slightly from the machine delivered to you. This merely indicates that your machine has been improved to better fulfill your requirements.

Address your inquiries or parts orders to;

HEIM CORP.

PARTS REPLACEMENT

AIR CLUTCH, 30/45 Ton

Removal; As a cartridge assembly.

Ref; Drg #C-410G

1. Remove the quick exhaust valve from the air swivel. See drg #C-390.
2. Remove the flywheel guard. See drg. #D-530C.
3. Loosen the motor mount and remove the V-belts from the motor pulley. Let them hang from the flywheel.
4. Remove the two bolts holding the cartridge to the side frame.
5. Remove the brake torque arms.
6. Support this assembly very carefully as it is extremely heavy when removed from the press. The whole assembly must be pulled straight out from the side frame. Use a twisting motion if necessary. BE CAREFULL!

Removal; part by part, 30/45 ton.

Ref; Drg #C-410G

1. Remove the quick exhaust valve from the air swivel. See drg. #C-390.
2. Remove the flywheel guard. see Drg. #D-530C.
3. Remove the bolt in the brake disc that holds the two brake torque arms. Allow the arms to hang free on the brake rod.
4. Remove the two hex. head bolts that hold the air swivel bridge. The bridge may then be removed. It may be necessary to tap it slightly to break the sealing compound. Later models have 'O' ring seals.
5. Loosen the set screw in the hub nut. Unscrew the hub nut. The piston plate, brake disc, and large clutch plate may now be slid off of the hub as an assembly.

NOTE

This assembly may be removed WITHOUT removing the air swivel bridge by pulling the assembly away from the flywheel as the hub nut is being unscrewed.

6. Slide the small clutch plate off of the hub and remove the friction discs.
7. Remove the set screw from the hub. Remove the hub from the shaft. It may be necessary to put the hub nut back on the hub and use a gear puller.

AIR CLUTCH, 70/100 ton

Removal; As a cartridge assembly.

Ref; Drg #C-410F

1. Follow same steps as described for removal of 30/45 cartridge assembly.

AIR CLUTCH, 70/100 ton

Removal; Part by part.

Ref; Drg #C-410F

1. Follow steps #1 thru #4 as described for removal of 30/45 ton part by part.
2. Remove the four bolts holding the piston plate to the hub. There are shims behind this plate. DO NOT LOSE OR BEND THEM. The piston plate, brake disc, and large clutch disc can now be removed as a unit.
3. Remove the friction discs and the steel discs from the hub.
4. Loosen the set screw in the clutch hub and slide it off the shaft.

PARTS REPLACEMENT

AIR CLUTCH, 150/200 ton

Removal; with integral brake.

As a cartridge assembly.

Ref; Drg. #D-2570

1. Follow steps #1 thru #6 as described for removal of 30/45 cartridge assy.

AIR CLUTCH, 150/200 ton

Removal; With integral brake.

Part by part.

Ref. Drg #D-2570

1. Follow same steps as described for 70/100 ton part by part.

AIR CLUTCH; 150/200 ton

Removal; Without integral brake.

Ref; Drg. #C-7320

1. Remove the quick exhaust valve from the air swivel.
2. Remove the flywheel guards.
3. Remove the eight bolts holding the outer plate to the flywheel. It may be pulled away from the flywheel, but be carefull that the clutch pressure plate does not fall out of this plate.
4. Remove the springs, spacers, and all discs from the clutch hub.
5. Loosen the set screw in the clutch hub and slide it off the shaft.

CLUTCH PISTON; All models with integral brakes.

Removal;

1. Remove the piston plate and brake disc assembly as described under clutch removal.
2. Remove the nuts, washers, springs, and bolts from this assembly.
3. The piston plate and clutch plate can now be seperated. Remove the brake disc from the piston plate.

CLUTCH PISTON; 150/200 ton without the integral brake.

Removal;

1. Follow steps #1 thru #3 as described under 'Clutch removal;150/200 ton without integral brake.'
2. Remove the clutch pressure plate from the plate just removed.
3. This piston is now exposed. It can be removed by using a dull flat instrument and prying it out of the plate. Inspect the piston and the plate for nicks, damage, dirt or evidence of leaking.

BRAKE DISC;All clutches with integral brakes.

Removal;

1. Remove the piston plate and brake disc assembly as previously described.
2. Remove the nuts, washers, springs, and bolts.
3. The piston plate and clutch plate can now be seperated. Remove the brake disc from the piston plate.

FLYWHEEL, All models

Removal;

1. Remove the air clutch as described under 'Removal; Part by part' for your press.
2. The flywheel may now be slid off of the shaft. It may be necessary to lift the flywheel slightly to make it easier to slide.

CAUTION!!

Be sure that the flywheel is safely and adequately supported BEFORE it is taken off the shaft.

PARTS REPLACEMENT

DRIVE PLUGS, 30/45 ton

Removal;

1. Remove the air clutch as described under 'Removal; part by part'. The flywheel does not have to be removed from the press.
2. Remove the socket head bolts holding the six plugs in place.

Installation;

1. Install the six new plugs as req'd. Before tightening the bolts, slide a clutch plate over the plugs to be sure there is no binding.
2. Tighten socket head bolts securely.

DRIVE PINS, 70/200 ton

Removal:

1. Remove the flywheel as previously described.
2. Measure the distance that the pins stick out from the flywheel. Write it down somewhere.
3. Drive the pins out of the flywheel from the rear.

Installation:

1. Drive in the new pins. Be sure the pins are driven in with the hardened end out.
2. Press pins in to the dimension taken in step #2 above.

FLYWHEEL BEARINGS, All models.

Removal;

1. Remove the flywheel as described under 'Flywheel, removal'.
2. Drive the old bearings out of the flywheel and install new ones. Be sure that the bearings are firm against the step in the flywheel or the ring on the bearing

FLYWHEEL PULLEY, 150/200 ton

Removal; Ref. Drg.#D-2570

1. Remove the flywheel as described under 'Flywheel-removal'.
2. Remove the bolts holding the pulley to the flywheel and remove the pulley.

FLYWHEEL SHAFT, 30/200 ton.

Removal; Cartridge type clutch

Ref; Drgs#C-410G,C-410F,D-2570

1. Remove the air clutch and flywheel as described previously.
2. Remove the two bolts holding the cartridge to the frame and remove the cartridge.
3. The pinion gear and the shaft may now be pulled out of the cartridge from the pinion gear end.
4. Remove the snap ring from the end of shaft and remove the gear from the shaft.

FLYWHEEL SHAFT, 150/200 ton

Removal: Clutch with disc brake

Ref; Drg #C-7420

1. Remove the air clutch and flywheel as described previously.
2. Remove the intermediate gear guard. see drg #D-530C.
3. Loosen the set screws in the two flange bearings.
4. Pull the shaft with the gear on it out of the bearings from the inside of the press.
5. Remove the snap ring from the shaft and remove the gear.

FLYWHEEL PINION, All models.

Removal;

1. Follow steps described above.

PARTS REPLACEMENT

BACKSHAFT PINION, All models.

Removal; Right side.

Ref; Drgs #C-460A & D-2710

1. Remove the air clutch and flywheel as deccribed previously.
2. The pinion gear is held in place with a gib-head tapered key. Remove this key.
3. Remove the pinion gear from the shaft.

Removal; Left side.

Ref; Drgs #C-460A & D-2710

1. Remove the left gear guard from the press.
2. The pinion gear is held in place with a gib-head tapered key. Remove this key.
3. Remove the pinion gear from the shaft.

BACKSHAFT, All models.

Removal; Ref. Drgs #C-460A & D-2710

1. Remove the air clutch and the fly-wheel as described.
2. Remove the backshaft pinion gears as described.
3. Remove the intermediate gear cover, see drg. #D-530C. This cover is made oil tight with sealing compound which must be broken loose. slide the gear cover out of the way.
4. Loosen the set screw holding the intermediate gear in place. Slide the gear (and a collar on the 30 ton thru 100 ton models) away from the side frame.
5. Loosen the shaft set screws in the four (4) flanged bearings bolted to the side frames.

6. On the 150/200 ton models, loosen the set screw in the disc brake hub.

7. The backshaft can now be slid out of the frame bearings, either from the right or the left. Remove all shaft keys before removing the shaft.

8. Do not let the intermediate gear or the brake disc fall off of the shaft. Remove them before the shaft is moved too far.

INTERMEDIATE GEAR, All models.

Removal; Ref. Drgs #C-460A or D-2710

1. Follow steps #1 thru #6 as described in 'Backshaft-removal'.
2. Slide the backshaft to the left and out of the bearings in the right side frame, enough to remove the intermediate gear.
3. Slide the intermediate gear off of the free end of the shaft.

DISC FOR DISC BRAKE, 150/200 ton

Removal; Ref. drgs #C-460A or #D-2710 and #C-7350

1. Follow steps #1 thru #6 as described in 'Backshaft-removal'.
2. Loosen the two bolts in the disc brake assembly (item #13 on drg. #C-7350) so that brake no longer clamps the disc.
3. Slide the backshaft out of the right side frame bearings. Slide it far enough to the left to remove the intermediate gear and the the gear cover and finally the brake disc.

PADS FOR DISC BRAKE, 150/200 ton

Removal; Ref. Drg #C-7350

1. Remove two bolts (item #13 on drg. #C-7350).

PARTS REPLACEMENT

2. The 1" bolts holding the assembly to the frame may have to be backed out slightly to allow enough space for the pads to come out.
3. Remove the old pads and blow out the pad pockets to remove any dust or dirt that has accumulated.
4. Slip in new pads and tighten all bolts that were loosened or removed.

BACKSHAFT BEARINGS, All models.

Removal; Right outboard.

Ref. Drgs #C-460A or D-2710

1. Remove the air clutch & flywheel
2. Remove the backshaft pinion gear on the right side.
3. Remove the bolts holding the flange bearing to the frame and loosen the set screws in the hub.
4. Remove the bearing by sliding it off of the backshaft.

Removal; Left outboard.

Ref. Drgs #C-460A or D-2710

1. Remove the left gear guard.
2. Remove the left backshaft pinion.
3. Remove the bolts holding the flange bearing to the frame and loosen the set screws in the hub.
4. Remove the bearing by sliding it off of the backshaft.

Removal; Right inboard.

Ref. Drgs #C-460A or D-2710

1. Remove the air clutch and flywheel.
2. Remove the backshaft pinion gear on the right end.
3. remove the intermediate gear guard cover. Loosen the set screw in the

intermediate gear and slide the gear and the cover out of the way.

4. Remove the left side gear guard.
5. Loosen the set screws in the hubs of all the backshaft flange bearings.
6. On the 150/200 ton models, loosen the set screw in the brake disc hub.
7. Slide the backshaft to the left and out of the right side frame bearings.
8. Remove the bolts holding the right inboard bearing to the frame and remove it.

Removal; Left inboard.

Ref. Drgs #C-460A or D-2710

1. Remove the air clutch and flywheel.
2. Remove the left gear guard.
3. Remove the backshaft pinion gear on the left side.
4. Remove the intermediate gear guard cover and loosen the set screw in intermediate gear hub.
5. On the 150/200 ton models, loosen the set screw in the brake disc hub.
6. Loosen the set screws in the hubs of all the backshaft flange bearings.
7. Slide the backshaft to the right and out of the left side frame bearings.
8. Remove the bolts holding the left inboard bearing to the frame and remove it.

ROTARY CAM, All models

Removal; Ref. Drg #D-120/D-130

1. Turn off electrical power to the press at the disconnect box. Lock the switch box closed with a padlock.

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2. Mark the end of the crankshaft and the rotary cam shaft with aligning marks.
3. Remove the torque arm from the cam box.
4. If the rotary cam box is to be removed completely from the press, the remove the cover, disconnect the wires at the terminal strip and remove the conduit from the box. If the rotary cam is not to be removed from the press but only swung out of the way for bearing removal, do not remove the cover or any wiring.
5. Remove the three bolts holding the cam shaft to the crankshaft.
6. Remove from the press or swing it up out of the way.

BULL GEAR, 30/100 ton

Removal; Left side.

Ref; Drgs #D-420A or D-1530

1. Remove the left gear guard.
2. Bend up the ear on the lockwasher on the end of the crankshaft.
3. Using a spanner wrench, remove the nut holding on the bull gear. The bull gear may now be removed from the crankshaft. NOTE: The bull gear fits onto the crankshaft with a tapered fit and it may be necessary to tap it to remove it!

Removal; Right side.

Ref; Drgs #D-420A or D-1530

1. Remove the right side gear guards.
2. Remove the air clutch and flywheel.
3. Bend up the ear on the lockwasher on the end of the crankshaft.

4. Using a spanner wrench, remove the

nut holding the bull gear. The bull gear may now be removed from the crankshaft. NOTE: The bull gear fits onto the shaft with a tapered fit and it may have to be tapped to break it loose.

BULL GEAR, 150/200 ton

Removal; Right side.

Ref; Drg #D-2610

1. Remove the air clutch & flywheel.
2. Remove the socket head bolt in the hub of the bull gear.
3. The bull gear may now be removed from the shaft.
4. When re-installing the socket head bolt the hole in the gear and the tapped hole in the key and the drilled hole in the crankshaft must all line up before the bolt can be installed.

Removal; Left side.

Ref; Drg. #D-2610

1. Remove the left gear guard.
2. Follow the same procedure as is described in steps #2 thru #4 above.

BEARING BLOCKS: All models.

Removal; Left outboard

Ref; Drgs #D-420A, D-1530, D-2610

1. Remove the left gear guard.
2. Remove the left bull gear.
3. Block up the ram in a safe manner so as to take the weight off of the crankshaft and bearing blocks.
4. Remove the lube line at the bearing block.

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5. Remove the locknut from the stud that holds the bearing block to the frame.
6. Remove the bearing block by sliding it off of the crankshaft.

Removal; Right outboard.

Ref; Drgs #D-420A, D-1530, D-2610

1. Remove the guards on the right side.
2. Remove the air clutch and flywheel.
3. Remove the right bull gear.
4. Block up the ram in a safe manner so as to take the weight off of the crankshaft and the bearing blocks.
5. Remove the lube line at the bearing block.
6. Remove the locknut from the stud that holds the bearing block to the side frame.
7. Remove the bearing block by sliding it off of the crankshaft.

Removal; Left inboard.

Ref; Drgs #D-420A, D-1530, D-2610

1. Block up the ram in a safe manner so as to take the weight off of the crankshaft and bearing blocks.
2. Remove the lube line from the bearing block.
3. Remove the locknut from the stud that holds the bearing block to the side frame.
4. Remove the bearing block by sliding it off of the crankshaft.

Removal; Right inboard.

Ref; Drgs #D-420A, D-1530, D-2610

1. Block up the ram in a safe manner so as to take the weight off of the

crankshaft and bearing blocks.

2. Disconnect the rotary cam from the crankshaft and swing it out of the way. It does not have to be disconnected electrically.
3. Remove the lube line from the bearing block.
4. Remove the locknut from the stud that holds the bearing block to the side frame
5. Slide the bearing block off of the crankshaft.

NOTE:

In all cases where the press has air counterbalance, the vertical bar may have to be disconnected and swung out of the way.

Replacement, All models.

1. Reverse the procedures as described above.
2. When tightening the stud locknut holding the bearing block in place, care must be taken not to bind the the crankshaft. Allow a total of 1/64" clearance between the crankshaft and the bearing blocks. The crankshaft should be centered between the frame plates by use of the locknuts.

CRANKSHAFT, All models.

Removal; Right Side.

Ref; Drgs #D-420A, D-1530 Or D-2610

1. Remove the air clutch and flywheel.
2. Remove the right side bull gear.
3. Block up the ram in a safe manner so as to take the weight off of the

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crankshaft and bearing blocks.

4. Disconnect the rotary cam box from the crankshaft and swing it up out the way. It does not have to be disconnected electrically.
5. Disconnect the lube lines at the crankshaft and the bearing blocks.
6. Remove the inboard and outboard bearing blocks.
7. The crankshaft and the connecting rod can be pivoted forward out of the frame.
8. When this assembly is clear of the frame, the crankshaft can be slid out of the connecting rod, either to the left or to the right.

CAUTION!

The crankshaft and other parts are too heavy for one person to handle. Use mechanical lifting devices for aid.

Removal; Left Side.

Ref. Drgs #D-420A, D-1530 or D-2610

1. Remove the left gear guard.
2. Remove the left bull gear.
3. Block up the ram in a safe manner so as to take the weight off of the crankshaft and bearing blocks.
4. Disconnect the lube lines at the crankshaft and the bearing blocks.
5. Remove the inboard and outboard bearing blocks.
6. The crankshaft and the connecting rod can now be pivoted forward out of the frame.
7. When this assembly is clear of the

frame, the crankshaft can be slid out of the connecting rod, either from the left or from the right.

CONNECTING ROD, All models.

Removal; Either Side.

Ref; Drgs #D-420A, D-1530 or D-2610

1. Run the ram down as far as it will go with the ram adjusting motor.
2. Remove the snap ring and the washer from the top of the adjusting screw.
3. Remove the crankshaft as previously described.
4. Unscrew the connecting rod from the adjusting screw. On the 150/200 ton models, remove the two socket head bolts holding the connecting rod nut to the connecting rod.

ADJUSTING SCREW, 30/100 ton.

Removal; Left Side.

Ref; Drgs #D-490B or D-490C

1. Run the ram down to within $\frac{1}{4}$ " of its lowest point with the ram adjusting motor.
2. Block up the ram in a safe manner so as to take the weight off of the parts being worked on.
3. Remove the ram indicator chain guard and the chain to the indicator.
4. Loosen the two set screws in the rigid coupling on the ram elevating shaft and slide it toward the center of the press.
5. Remove the snap ring and the washer from the top of the adjusting screw.
6. Loosen the set screw locking the upper bronze socket nut and remove the nut.

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7. Remove the two bolts holding the gear housing the ram and slide out the stroke spacer (when furnished) located between the housing and the ram.
8. The gear housing assembly can now be pivoted forward. Do this slowly so you can remove the lower bronze socket from the bottom of the gear housing. Swing the gear housing forward far enough to clear the ram and lower it out of the adjusting screw.
9. The adjusting screw can now be unscrewed from the connecting rod.

CAUTION!

Parts & assemblies are very heavy!
USE HELP!

Removal; Right Side.

Ref; Drgs #D-490B or D-490C

1. Run the ram down to within $\frac{1}{4}$ " of its lowest point with the ram adjusting motor.
2. Block up the ram in a safe manner so as to take the weight off of the parts being worked on.
3. Remove the right side ram indicator chain guard and the chain to the indicator.
4. Remove the chain guard covering the sprocket on the ram elevating shaft. Remove the chain from the sprocket.
5. Loosen the set screw in the hub of the sprocket. Slide the sprocket toward the gear housing as far as it will go. Remove the key from the shaft.
6. Loosen the set screw (or remove the pin) from the stationary half of the shaft coupling. Move this half of the coupling along the shaft toward

the gear housing.

7. Remove the snap ring and the washer from the top of the adjusting screw.
8. Loosen the set screw locking the upper bronze socket nut and unscrew the nut from the gear housing.
9. Remove the two bolts holding the gear housing to the ram and slide out the stroke spacer (when furnished) located between the housing and the ram.
10. The gear housing assembly can now be pivoted forward. Do this slowly so you can remove the lower bronze socket from the bottom of the gear housing. Swing the gear housing forward far enough to clear the ram and lower it out of the adjusting screw.
11. The adjusting screw can now be unscrewed from the connecting rod.

ADJUSTING SCREW, 150/200 ton

Removal; Left Side

Ref; Drg #D-490C

1. Follow the same instructions as is described for 30/100 ton from step #1 through step #7.
2. Remove the bolts holding the connecting rod nut to the connecting rod.
3. The gear housing assembly can now be pivoted forward. Do this slowly so you can remove the lower bronze socket nut. READ CAUTION NOTE.
4. When the assembly has been removed from the press and is safely on the floor or work bench, the connecting rod nut can unscrewed from the adjusting screw. Remove the adjusting screw from out of the bottom of the gear housing.

PARTS REPLACEMENT

CAUTION!!!

These assemblies are extremely heavy! Support them with an overhead hoist or slide them onto a skid on the forks of a lift truck.

If an overhead hoist is used, leave the upper socket nut in place and sling around the adjusting screw below the connecting rod nut.

ADJUSTING SCREW, 150/200 ton.

Removal; Right Side.

Ref; Drg #D-490C

1. Follow the same instructions as is described for 30/100 ton, right side, steps #1 through #9.
2. Remove the two bolts holding the connecting rod nut to the connecting rod.
3. The gear housing assembly can now be pivoted forward. Do this slowly so you can remove the lower bronze socket nut from the bottom.
READ AND HEED THE CAUTION NOTE!
4. When the assembly has been removed from the press and is safely on the floor or work bench, the connecting rod nut can be unscrewed from the connecting rod.

CAUTION!!!

These assemblies are extremely heavy! Support them with an overhead hoist or slide them onto a skid on the forks of a lift truck.

If an overhead hoist is used, leave the upper socket nut in place and sling around the adjusting screw below the connecting rod nut.

RAM ELEVATING SHAFT WORM, 30/45 ton RAM ELEVATING SHAFT BEARINGS

Removal; Left Side.

Ref; Drg. #D-490B

1. Remove the ram indicator chain guard and the chain from the left side.
2. Loosen the set screws in the rigid coupling on the ram elevating shaft.
3. Loosen the set screw in the shaft collar located next to the gear housing.
4. Loosen set screw (item #48) and unscrew the bearing nut (item #9) out of the gear housing.
5. The worm can now be removed by turning the shaft. This unscrews the worm from the gear and pushes the bearing along with it. When the worm is free of the gear, pull the shaft along with the worm and bearing out of the gear housing. The opposite bearing can now be pushed out of the housing with a soft metal drift.
6. Separate the worm and the bearing from the shaft.

Removal; Right Side.

Ref; Drg. #D-490B

1. Run the ram down to its lowest point with the ram adjusting motor.
2. Block up the ram in a safe manner so as to take the weight off of the parts to be worked on.
3. Remove the ram indicator chain guard and chain from the right side.
4. Remove the chain guard covering the sprocket on the ram elevating shaft. Remove the chain from the sprocket.
5. Loosen the set screw (or remove the

PARTS REPLACEMENT

pin) from the stationary half of the shaft coupling. Move this half of the coupling toward the gear housing.

6. Loosen the set screws in the shaft collar located next to the gear housing.
7. Loosen the set screw (item #48) that locks the upper socket nut (item #9) and unscrew the nut out of the gear housing.
8. Remove the two bolts holding the gear housing to the ram.
9. Rotate the shaft in the gear housing to turn the adjusting screw UP into the connecting rod, until the housing is about 1/8" above the ram.
10. Pull the entire assembly out of the split coupling and turn it until the shaft is about 30 degrees to the ram.
11. The worm can now be removed by turning the shaft. This unscrews the worm from the gear and pushes the bearing along with it. When the worm is free of the gear, pull the shaft along with the worm and bearing, out of the gear housing. The opposite bearing can be pushed out of the housing with a soft metal drift.
12. Separate the worm and bearing from the shaft.

RAM ELEVATING SHAFT WORM, 70/200 ton. RAM ELEVATING SHAFT BEARING.

Removal; Left Side.
Ref; Drg. #D-490C

1. Remove the ram indicator chain guard and chain from the left side.
2. Loosen the set screws in the rigid coupling on the ram elevating shaft.
3. Remove the two bolts from the rear of the gear housing. Loosen the set

screw in the shaft collar located next to the gear housing.

4. Rotate the shaft so as to unscrew the worm from the gear. The worm will push the bearing and the bearing adapter (item #8) along with it.
5. When the worm is free of the gear, pull the shaft along with the bearing and adapter out of the gear housing. The opposite bearing and adapter can be pushed out of the housing with a soft metal drift.
6. Separate the worm and bearing from the shaft.

Removal; Right Side.
Ref: Drg. #D-490C

1. Remove the ram indicator chain guard and chain from the right side.
2. Remove the pin from the stationary half of the split coupling. Move this half of the coupling toward the gear housing.
3. Remove the chain guard covering the sprocket on the ram elevating shaft. Remove the chain. Loosen the set screw in the sprocket hub.
4. Remove the two bolts at the rear of the gear housing and loosen the set screw in the shaft collar located next to the housing.
5. Rotate the shaft so as to unscrew the worm from the gear. The worm will push the bearing and the bearing adapter along with it.
6. When the worm is free of the gear, there should be enough room to remove the sprocket, the coupling half and the shaft collar from the inside part of the shaft. Pull the shaft along with the worm, bearing and adapter, out of the housing. The opposite bearing and adapter can be pushed out of the housing.

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7. Separate the worm and bearing from the shaft.

BRONZE LOWER SOCKET, All models. BRONZE WORM GEAR

Removal; Left Side.

Ref. Drgs. #D-490B OR D-490C

1. Lower the ram to its lowest point with the ram adjusting motor.
2. Block up the ram in a safe manner so as to remove the weight from the parts to be worked on.
3. Remove the ram indicator chain guard and chain from the left side.
4. Loosen the set screws in the rigid coupling and slide it toward the center of the press. Remove the keys from the shaft.
5. Remove the two bolts holding the gear housing to the ram.
6. Rotate the shaft that goes thru the gear housing so as to turn the adjusting screw UP into the connecting rod. As the screw moves the housing upward, first the stroke spacer (if furnished) can be removed and the the lower socket.
7. If the Bronze gear is to be removed, continue raising the housing as far as it will go.
8. The worm and worm shaft will have to be removed. See previous instructions.

Removal; Right Side.

Ref; Drgs.#D-490B or D-490C

1. Lower the ram to its lowest point with the ram adjustment motor.
2. Block up the ram in a safe manner so as to take the weight off of the parts to be worked on.

3. Remove the ram indicator chain guard and chain from the right side.
4. Remove the pin from the stationary half of the split coupling. Move this half of the coupling toward the gear housing.
5. Remove the chain guard covering the sprocket on the ram elevating shaft. Remove the chain. Loosen the set screw in the sprocket hub.
6. Remove the two bolts holding the gear housing to the ram. Pull the gear housing assembly until the shaft comes out of the split coupling and then turn it until it is about 30 degrees to the ram.
7. Rotate the shaft that goes thru the gear housing so as to turn the adjusting screw UP into the connecting rod. As the housing moves up, first the stroke spacer (if furnished) can be removed and then the lower socket nut.
8. If the bronze worm gear is to be removed, continue raising the housing as far as it will go.
9. The worm and worm shaft will have to be removed from the housing before the worm gear can be removed. See previous instructions.

RAM GUIDE, All models RAM GUIDE ROD.

Removal; Either Side.

Ref; Drg. #C-430A

1. Place wooden blocks in the throat of the press in such a manner as to keep the ram guide from dropping when it is unbolted from the ram.
2. Remove the four bolts (two on each side) that hold the ram to the ram guides.
3. Remove the lubrication lines from

PARTS REPLACEMENT

ram guides.

4. Swing the entire ram assembly up by pivoting it on the connecting rods at the crankshaft. Block it up in a safe manner.

CAUTION!!!

Since it will be necessary to work under the blocked up ram, it is very, very important that it is blocked up in a very safe and fool proof method. Don't let a fork truck knock the props out!

5. Remove the upper and lower bolts that that hold the guide rods to the frame. The ram guide AND the ram guide rod can now be removed. NOTE! These parts are very heavy. Have some one help you!
6. Remove the rod from the guide.

RAM GUIDE BEARINGS, All models.

Removal; Ref. Drg #C-430A

1. Remove the ram guide as described under 'Ram Guide-Removal'.
2. Remove the safety lock bolt (item #4) and washer holding the bronze bearings in place.
3. Drive the bearing out of the housing from the inside to the outside only.

RAM; All Models.

Removal; Ref. Drgs #C-430A, D-490B, D-490C and D-7310.

1. Remove the ram indicator chain guards and chains from both ends.
2. Remove the chain guard covering the

sprocket on the ram elevating shaft. remove the chain.

3. Unbolt the ram elevating shaft support bearing (when furnished) from the back of the ram.
4. Block up the ram guides to keep them from dropping when ram bolts are removed.
5. Remove the air lines from the ram adjusting motor and control valve.
6. With a chain hoist or overhead crane OF SUFFICIENT CAPACITY, sling the ram and lift it slightly to remove the weight from the adjusting screw.
7. Remove the bolts from the air counter balance rods at the ram.
8. Remove the four bolts holding the ram to the ram guides.
9. Remove the two bolts from each side that hold the gear housings to the ram. This disconnects the ram from the rest of the press. DO THIS OPERATION CAREFULLY and be sure your slings and lifting means are adequate and secure!
10. Swing the ram away from the press and lower it to the floor. Lay it on wood blocks. Remove the remaining parts from the ram.

AIR COUNTERBALANCE CYLINDERS, All models

Removal; Ref. Drg. #D-7310

1. Exhaust air from the system.
2. Remove the rod from the ram to the cylinder, at the cylinder.
3. Remove air lines from the cylinder.
4. Remove the four bolts holding cylinder to the press. Lift the cylinder up and out of the mounting pad and lower to the floor.

ADJUSTMENT

CLUTCH ADJUSTMENT, 30/45 ton

Ref; Drg. #C-410G

1. Turn off electrical power to the press. Maintain air pressure to the press.
2. Loosen set screws (item #33) in the clutch hub nut.
3. Tighten the hub nut until the plates only move about 1/64". Activate the clutch without the flywheel turning observe the movement of the plates.
4. Do not tighten to where the plates drag. This causes the clutch to overheat and the flywheel to slow down.
5. When final adjustment is made, then tighten down the set screws in the hub nut.

BRAKE ADJUSTMENT, 30/45 ton

Ref; Drg. #C-410G

1. Measure the distance from the clutch plate to the underside of the flat washer on the six bolts with the springs on them. This dimension should be 7/8".
2. Turn the nuts (item #36) down until this dimension is 7/8" on all of the bolts. Heavier rams or dies may require more spring pressure. Do not adjust below 3/4".
3. When the brake disc wears to a certain point, the steel plates will not clamp it any more and tightening down the nuts will not help it. Replace the brake disc.

CLUTCH ADJUSTMENT, 70/100 ton.

Ref; Drg. #C-410F

1. Remove the cotter pins (item #51)

from the brake rod (item #14).

2. Remove the four bolts (item #46) holding the piston plate and brake disc assembly to the clutch hub. Slide this assembly off the hub.
3. Remove shims (item #29) as required to obtain minimum plate movement in the clutch without any drag.
4. Replace the piston plate and brake disc assembly to the clutch hub. Replace bolts and cotter pins.

BRAKE ADJUSTMENT, 70/100 ton.

Ref; Drg. #C-410F

1. Follow same instructions as described for 30/45 ton.

CLUTCH ADJUSTMENT, 150/200 ton with integral brake.

Ref; Drg. #D-2570

1. Follow same instruction as 70/100 ton.

BRAKE ADJUSTMENT, 150/200 ton with integral brake.

Ref; Drg. #D-2570

1. Follow same instructions as for 30/45 ton.

CLUTCH ADJUSTMENT, 150/200 ton with disc brake.

Ref; Drg. #C-7320

1. This clutch is a self compensating type and requires no adjustment.

ADJUSTMENT

ADJUSTING SCREW AND UPPER SOCKET NUT ADJUSTMENT, All models.

Ref; Drgs. #D-490B or D-490C

1. Lower the ram down onto wood blocks placed at each end between the ram and the bed. Blocks should be of such height that the ram is almost at its lowest adjustment.
 2. Loosen the set screw that locks the the upper socket nut from turning.
 3. With the proper spanner wrench, turn the upper socket nut down to a light snug fit. Back off 1/8th of turn and lock the set screws.
 4. Raise the ram with the ram adjusting motor and remove the wooden blocks.
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ADJUSTMENT

ADJUSTING SCREW AND UPPER SOCKET NUT ADJUSTMENT, All models.

Ref; Drgs. #D-490B or D-490C

1. Lower the ram down onto wood blocks placed at each end between the ram and the bed. Blocks should be of such height that the ram is almost at its lowest adjustment.
 2. Loosen the set screw that locks the the upper socket nut from turning.
 3. With the proper spanner wrench, turn the upper socket nut down to a light snug fit. Back off 1/8th of turn and lock the set screws.
 4. Raise the ram with the ram adjusting motor and remove the wooden blocks.
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